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AN ESSAY

ON THE

LARYNGISMUS STRIDULUS.

OR

CROUP-LIKE INSPIRATION OF INFANTS.

TO WHICH ARE APPENDED

ILLUSTRATIONS OF THE GENERAL PRINCIPLES OF THE
PATHOLOGY OF NERVES,

AND OF THE FUNCTIONS AND DISEASES OF THE
PAR VAGUM AND ITS PRINCIPAL BRANCHES.

BY

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Illustrated with Plates.

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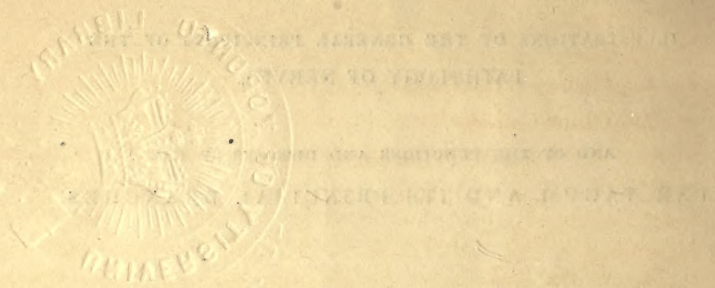
MDCCCXXXVI.

AN ESSAY

LARYNGISMUS STRIDULUS

(WHOLE) OR INSPIRATION OF INFANTS

IN WHICH ARE CONTAINED



HUGH JAY, M.D.

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PREFACE.

THE very peculiar disease, which it is the object of the following Essay to investigate, has been long known; and its dangerous tendency has been, perhaps, rather exaggerated than under-rated.

Its existence, indeed, as a complaint separate and distinct from croup, has been a fruitful source of controversy upon the continent, where it is much less frequent than in this country:—but, even here, constantly as we have opportunities of observing it, the opinions of the profession are still unsettled as to its pathology and treatment.

The views hitherto entertained by those, who have either written expressly on this malady, or noticed it incidentally in their writings, have been much wanting in precision, perspicuity, and accuracy. They have differed also greatly from each other, and hence not only dissimilar, but even contrary, modes of treatment have been adopted; some speaking in terms of the greatest confidence of the successful results of copious blood-letting, large and reiterated doses of calomel, active purgatives, and very slender diet, whilst others denounce these remedies as useless or pernicious, and advocate the employment of a totally opposite practice, recommending

strongly a tonic regimen, including quinine, nutritive food and country air.

My opportunities, both in public and private practice, of tracing this disease from its commencement to either its favourable or its fatal termination, have been numerous. These have, I would fain hope, enabled me to clear up some of the obscurities, to reconcile the discrepancies, and to discover and correct some of the practical errors, which are so manifest in the very brief accounts of this disease which have hitherto been presented to the professional public; and if, by tracing the morbid changes upon which, in at least a very large numerical majority of instances, the disease depends, I shall be able to explain more satisfactorily the phenomena, or establish more definite rules for the management of the complaint, my time and labour will not have been misapplied, and my purpose will have been attained.

The work, composed at different times, often at somewhat distant intervals, and under the pressure of severe indisposition and laborious professional occupations, has, I am abundantly aware, numerous imperfections and occasional repetitions; and it has grown under my hands until a few brief communications to a periodical medical journal, in which I sketched an outline of my views, have become a portly volume. I have found it difficult, however, or rather impracticable, to compress within a narrower compass the numerous facts and observations which the illustration of my subject required, and I was much influenced by the opinion of a distinguished French physiologist, that "*il vaut mieux pêcher par excès que par défaut de preuves, quand il s'agit d'établir une théorie nouvelle, d'ajouter une vérité aux vérités déjà connues: on ne dit jamais trop alors, tant il est difficile de convaincre.*"¹ At all events, since the time of Millar,²

¹ Brachet.

² Observations on the Asthma and on the Hooping Cough, by John Millar, M.D. 1769.

there has been no monograph of this disease, and it appeared to me to be well worthy of a detailed consideration.

Most of the cases which I have related occurred within my own observation and I can vouch, therefore, for their authenticity and accuracy. I have, however, had occasion also to refer to instances recorded by other individuals equally entitled to professional confidence, and these have forced conviction upon my mind, that the general opinion with regard to the pathological essence of this complaint is in most instances erroneous. With regard to the conclusions to which I have been led, the result, I trust, of no hasty generalization or illogical induction, I have little expectation and less desire that they should be adopted without a searching examination of the proofs upon which they rest. I know how difficult it is to eradicate the impressions of early education and to combat the influence of habitual trains of thought; and it will, probably, be with others as it has been with myself. I entered upon the investigation of this disease much biassed by the, all but, universal belief, that it was essentially a convulsive malady; and it was only in the progress of my observations and inquiries that I could disabuse my mind of this very common opinion, which I found to have, instead of evidence, little better than the dicta of the profession in its support, to be consistent with very few of the phenomena, to afford no satisfactory explanation of the symptoms, and to be totally irreconcilable with a large proportion of the facts.

How far I may have succeeded in establishing the startling proposition that this complaint is, generally, more allied to partial or local paralysis than to convulsive movement, it is not for me to determine. But multiplied experience, observation, and reasoning, confirmed by physiological experiments and pathological inquiries, have convinced me of its truth; and each succeeding instance of the malady which has presented itself to my notice, has but tended still more to

fortify my opinions. The facts, by which they are supported, have addressed themselves so forcibly to the eye of reason as well as of observation, that their influence has been irresistible. I felt with Galen, that "*si quis non credit iis quæ per sensum et intellectionem evidenter patent vanum erit constitutioni alicujus artis operam navare,*" or as Brassavolius compresses the same sentiment in his reference to this passage, "*Sensui qui non credit explodendus est.*"

Some apology may, perhaps, be requisite for entering so largely, as I have done in the Appendix, upon the subject of the general principles of the pathology of nerves. Without reference to these I found it impracticable to proceed with any explanation or illustration of the complaint so aptly, though quaintly, designated "child-crowing" by my lamented friend and colleague, the late Dr. Gooch. It appeared, upon examination of the subject, that although a mass of valuable materials might be collected from the writings of those, who had directed their attention to the diseases of these all-pervading instruments of sense and motion, no very perspicuous attempt had been made to bring together the numerous and instructive observations, to arrange and generalize the facts, and to deduce such general inferences, as might be useful to future inquirers. I was forcibly struck, when consulting the best authorities upon the subject, with the truth of a remark by Dr. Alison, that "there is in many medical writings an indifference to the establishment of such general principles, both in physiology and pathology, as the information we already possess sufficiently warrants, which argues inattention to the value and importance of these principles not only for the gratification of the desire of knowledge, but for securing the recollection and useful application of individual facts."³

It was this deficiency which obliged me to investigate the subject for myself; and in collecting the requisite materials

³ Outlines of Physiology and Pathology. Preface, vi.

I have endeavoured to exclude all such recorded instances of diseased conditions of individual nerves, as appeared to be stated upon insufficient testimony, or were not minutely examined. The labour of the research has, I trust, not been altogether unproductive. The results are, at all events, not without interest; and if they should tempt others, who have more leisure and less limited opportunities, to pursue a similar train of investigation, or should they afford any assistance in such inquiries, I shall not regret the time I have devoted to the elucidation and illustration of a subject so comprehensive, obscure, and intricate.

But it was not enough thus to attempt the establishment of general principles connected with the pathology of nerves, without tracing at the same time their application to the par vagum, with the diseased conditions, structural or functional, of which, and more particularly of its recurrent branches, the phenomena of the laryngismus stridulus have the most intimate connexion. It was necessary, for this purpose, to follow the course of the nerve to its ultimate distribution, to ascertain, by the positive and negative results of physiological experiments, the functions to which its various ramifications minister, and to adduce illustrative examples of the changes in its attributes and offices produced by disease. In this part of my inquiry I have availed myself largely of the physiological labours of British and continental writers, and of such pathological observations as fell within my reach. These have in a striking manner corroborated my views as to the essential nature—the proximate cause as it is generally termed, though it is the disease itself—of the crowing or croup-like inspiration of infants, and have convinced me, in opposition to the prevailing doctrine, that in the distressed and stridulous breathing, which attends the laryngismus stridulus, the respiratory nerves, to the entire exclusion of all morbid condition within the cranium, *may be* in fault.—*Sæpe nervorum culpâ,*

insonte cerebro, turbari respirationem posse manifestum est. Itaque sive nervi qui ad respirandum inserviunt, sive illi qui cum his demum sunt colligati, aut acrius irritentur, aut premantur, obstruantur, intimeve pervertantur, ab alterutris nervis respirationem lædi posse perspicuum est.⁴

⁴ Morgagni, Epist. Anat. Med. xv. art. 10.

INTRODUCTION.

A BRIEF sketch of the literary history, which is somewhat curious, of the *Laryngismus Stridulus* may, perhaps, constitute no uninteresting or useless introduction to the investigation of its medical history. We are assured by one original writer upon the subject, that "though no complete history has ever been given of the disease, yet there are several observations concerning it scattered through the writings of practical physicians."¹ A second mentions it as "a disease conceived by some gentlemen of great respectability and experience, as generally fatal."² A third states, that "it is a complaint of such rare occurrence that it has been little attended to by practitioners, and has not been described by any author."³ A fourth alleges "that it is often mistaken and treated as some other disease even by medical men; and the true nature of it has been little known even to practitioners generally conversant with children's diseases;" and that "it is therefore less likely to be detected by those, who have bestowed little or no attention upon them."⁴ A fifth gives it as a reason for "dwelling on the characteristic features of the disease," that he does "not find it described in any systematic work in the English or French language."⁵ And, lastly, a sixth "believes it has never been regularly described."⁶

Notwithstanding, however, these illustrations of the little attention this disease is said to have attracted, it appeared to

¹ Millar, 1769.

² Underwood, 1789.

³ Hamilton, 1813.

⁴ Clarke, 1815.

⁵ Marsh, 1830.

⁶ Gooch, by Skinner, 1831.

me extremely improbable that a complaint, which is dependant upon the physical agency of causes which have been always in operation, could have altogether escaped the observation of practical writers upon medicine. I concluded, therefore, that it must have been with this disease as Royer Collard alleges with regard to croup, that "les causes qui concourent à la production de la maladie ont existé de tout tems, et il serait bien extraordinaire qu'elles fussent restées inactives, et, pour ainsi dire, silencieuses pendant une longue suite de siècles, pour se reveiller avec une énergie aussi féroce que subite."⁷ Accordingly, although it is unquestionably true that to the late Dr. John Clarke is due the merit of having first succeeded in fixing strongly the attention of the profession upon this interesting, distressing, and sometimes mortal malady, I still found, as I had anticipated, that long previously to his time, and even from the earliest ages, to which the records of our art extend, very distinct and unequivocal notices of its occurrence were to be found in the writings of medical authors. M. Double thinks that he finds a trace of croup as early as the Rabbinical writings; but it seems more probable, that the complaint noticed by Elias the Levite, in his *Thisbi*, was the laryngismus, since he describes it as destroying in an instant by closing the entrance to the windpipe.

Whatsoever difference of opinion, as to the causes and intimate nature of this complaint, may have existed amongst those who have noticed it in their writings, or howsoever numerous and various the denominations under which they have described it, there has still been that uniformity in the accounts of its characteristic features, which enables us at once to identify the disease as similar or the same in all. The phenomena, almost invariably observed, have been severe, but paroxysmal, distress in breathing, threatening and sometimes producing irrecoverable suffocation, and, in cases of recovery, accompanied or immediately succeeded by, and terminating in, a lengthened sonorous inspiration like that which occurs in croup and whooping-cough. These are mentioned as the leading and pathognomonic signs of the disorder by almost

⁷ Dict. des Sc. Méd. Art. Croup.

all modern writers including Millar, Rush, Underwood, Burns, Hamilton, Capuron, Clarke, Cheyne, Pretty, Davies, North, Golis, Gooch, Marsh, Joy, and Robertson.

Other phenomena have been enumerated by some amongst the symptoms, but they are merely accidental associations or consequences, and are not essential to the complaint. Some, again, and especially amongst the earlier writers, have omitted the croup-like inspiration, but the other circumstances are so analogous to those of the laryngismus stridulus, that I cannot divest my mind of the belief that the complaint described by them is no other than that disorder. But these incidental combinations and occasional omissions do not affect the essence of the disease; at most they can only constitute varieties, and are not sufficient to justify our founding upon them even a specific, and certainly not a generic distinction.

Until the beginning of the present century this complaint appears to have been commonly described under the very general and somewhat vague title of “asthma,” which, together with struma and several other complaints, Hippocrates enumerates amongst the diseases of children advanced somewhat beyond the time of life when the first teeth begin to appear;⁸ a period more minutely, if not more accurately, defined by Galen to extend from the first appearance of these teeth to the age of twelve or thirteen.⁹ In another part, also, of his voluminous writings, Hippocrates mentions the “asthma” as a disease of childhood, as particularly apt to occur “during winter, in cities whose confined situation precludes them from due exposure to the evaporating influence of the sun and winds, where the inhabitants are subject to the violent alternations of hot summers and cold winters, and where the only water they have is from marshes or standing pools;” and, further, as connected, or confounded with or constituting an attack of epilepsy.¹ Some indeed have expressed their

⁸ Hipp. Aph. sect. 3, aph. 26.

⁹ Galen Comm. 3. in Aph. Hipp.

¹ τοῖσι τε παιδίοισιν ἐπιπίπτειν σπασμοὶς καὶ ἰσθμάτα ἃ νομίζουσιν τὸ παιδίον ποιέειν καὶ ἱερὴν νόσον εἶναι.

Περὶ ἀερῶν, ὑδάτων, τόπων. Hippoc. Fœsii. Francof. 1621, p. 281.

* doubts whether Hippocrates meant, by the expression employed—"ἱερὴν νόσον"—more than a very severe disease or a visitation of the gods; but it is well-known that the ancient writers commonly used this expression to designate the disease called the falling sickness or epilepsy and Galen, in another part of his works² quoting this passage of Hippocrates, expressly identifies it as the "τὸ τῆς ἐπιληψίας πάθος."

The sense, in which the terms *asthma* and *struma* were used by Hippocrates, must be gathered from writers, who may be supposed to be the most conversant with the meaning of these expressions, because least remote from the time of the author himself, and because abundantly familiar with the language in which he wrote. So Galen tells us, that by the term *asthma* is meant that kind of difficulty of breathing, which occurs in those who have been running violently, or have been agitated by any other kind of vehement exercise;³ and a similar explanation is given by Aretæus⁴ and Paulus of Ægina.⁵ Celsus defines the word "*asthma*" with even still more exactness, and distinguishes it from *dyspnœa*; restricting the latter to those more moderate cases of difficult breathing which are without a sense of strangulation, and applying the former to those in which the difficulty is extreme and the *respiration sonorous*.⁶ Cœlius Aurelianus also alludes to *asthma*, as a disease afflicting men more frequently than women, old people and *children* more frequently than those of youthful age, the delicate rather than the strong, as attended *with a sense of suffocation, sonorous wheezing respiration and enfeebled voice*, and in its very severe forms with lividity of lips, and as liable to occur in winter more frequently than in summer, in the night rather than by day.⁷

Such being the acceptation in which the word *asthma* was used by the ancients, and it being notorious that *spasmodic asthma*, in the more restricted sense in which the name is now

² Com. 1 in lib. 6. Hipp. sect. 1. de Morb. Vulgaribus.

³ Galen Comm. 3 in Aph. Hipp.

⁴ Aret. περὶ χρόνων παθῶν. Cap. 2.

⁵ Æginet. lib. 3, cap. 29.

⁶ Celsi de re Medica, lib. 4, cap. 2.

⁷ Cœl. Aureliani Morb. Chron. lib. 3, cap. 1.

applied, is an extremely rare disease amongst infants and children, it is highly probable that when Hippocrates and Galen mention asthma unconnected with cough, as a disease of childhood, they must have meant that peculiar malady which it is my purpose to investigate: and this probability is reduced almost to certainty when we find that, in the enumeration by Hippocrates of diseases thus incident to the age of childhood, he has also comprehended struma, which Galen⁸ and all the ancient writers agree in describing as “indolent glandular tumours, particularly apt to affect the neck;” thus associating, as Millar, Molloy, and perhaps, in our own time, Marsh have done, these two affections which so constantly coexist in the same individual.

There can be little doubt that a case, described in the seventeenth century by Felix Plater, was an interesting and fatal example of this disease. A boy five months old, of sound habit of body, and free from previous disease, was seized with sonorous and difficult breathing, and died suddenly. The father, anxious to ascertain the nature of a disease, which had already deprived him of two of his children, was desirous that the body should be opened, when the only morbid change of importance, which could be detected, was a large strumous gland, weighing an ounce and a half, having a membranous adhesion to the great vessels of the neck, the compression of which, it was thought, must have occasioned the suffocation. The facts thus briefly recorded possess great interest, but the explanation offered, although in consonance with the views generally entertained in the time of Plater, is little satisfactory. Pressure upon the great vessels of the neck, it is now well known, produces no such symptoms as those described; and it can scarcely admit of question, as the tumour was placed immediately over the course of the respiratory nerves, that it was to compression either of the

⁸ Struma caro est sicca quæ nec facile solvitur. Galen. Finit. Medic.

Cervicem habent synanche, cynanche, strangulatio, vertebrarum expulsio, strumæ, steatomata.—Galen, de externis capit. affect.

Quæ vel præcipue fatigare medicos solent quoniam et febres movent, nec unquam facile maturescunt.—Celsi lib. 5, cap. 23, sect. 7.

par vagum, or, more probably, its recurrent branch, that the difficult and stridulous breathing was owing; and that the sudden death was attributable to some sudden and accidental aggravation of that pressure.⁹

Primerosius,¹ in the middle of the same century, describes the asthma amongst the diseases of children, and Etmuller,² who wrote towards the conclusion of the same century, confirms by adoption his statement, defines more accurately what was meant by the term, mentions it as one of the ailments connected with dentition, and as only occasionally associated with cough; notices the difficulty of breathing attended with sonorous respiration, which he denominates “stertor,” and which he expressly identifies as the same sound with that which occurs in the whooping cough, traces it to acidity, or acrid secretions, or a loaded stomach, and whilst he inveighs against checking a spontaneous, recommends strenuously artificial vomiting for the cure of the disease.³ In his chapter, also, “de catarrho suffocativo,” he still more plainly alludes to it, for, “to this head,” he says, “should be referred the suffocative catarrh, apt to be followed by convulsions, of infants, in which the alternate actions of inspiration and expiration, exceedingly hurried and *with little or no cough*, are attended with the frequent appearance of suffocation;”⁴ and this he believes to be essentially an affection of the larynx.⁵

⁹ F. Plateri Obs. lib. 1, p. 184.

¹ De puerorum morbis, p. 73.

² Idem asserendum de infantum asthmate, quod ut plurimum ex ventriculo onerato oritur, dum mucilagines acidæ exacervatæ et flatulentâ turgescentiâ tumefactæ molestum tale asthma producent; hinc enim etiam provocato vomitu statim liberantur.—*Valetud. Infant.* §. 23.

³ Sed ut supra monui non est cito nimis cohibendus vomitus, imprimis quando nausea urget, aut stertor anhelando auditur, quin potius in tussi ex stomacho, præ cæteris tussis speciebus furibunda, difficilique respiratione, et asthmatico affectu, studiose nisi sponte superveniat vomitus, provocandus erit; præsens namque levamen affert.—*Ibid.* cap. iii. §. 10.

⁴ Pertinere huc videtur infantum quorundam plus minus robustorum catarrhus suffocativus cum epilepsiæ metu junctus, dum v. g. simpliciter creberrima thoracis systole et diastole cum levi vel nulla tussi continuo suffocari videntur.—*Op. Omn.* 1697, vol. ii. p. 273.

⁵ Ex dictis elicitur, catarrhum hunc suffocativum, proprie loquendo, esse affectionem laryngis in quo hæc et caput asperæ arteriæ, in specie epiglottis afficitur primario.—*Ibid.* p. 273.

It is also very far from improbable, that the complaint, which he elsewhere describes under the title of the "suffocatio convulsiva," is of the same kind; and it is a curious and interesting fact, connected with his account of this peculiar form of disease, that he should distinctly allege that it may occur from paralysis, as well as from spasm of the muscles of the glottis,⁶ the symptoms of both being similar or identical.

A contemporary and friend of Sydenham, Dr. Walter Harris, whose little work upon the acute diseases of infants gave the first impulse, in this country, to the investigation of the ailments of children, was probably not unacquainted with this laryngeal affection. Speaking of the complaints arising from excess of acidity in the primæ viæ, to which it was his habit to ascribe most of the maladies of infantile life, after enumerating amongst them nausea, vomiting, acid eructations, a pallid, sallow, or even greenish tinge of complexion, reddish pustules (the strongest evidence according to him of redundant acid) upon the cheek, chin, forehead, neck, or sometimes the lower parts of the body, he adds, of such patient, "*Sed et idem anhelat et cum stertore aures astantium feriente nonnunquam spiritum ducit.*"⁷ That the word "anhelat," here employed, means not merely panting or difficulty of breathing, is more than probable from the literary habits and pursuits of Harris, who would naturally apply the term in the sense, in which it was commonly employed by the ancient medical writers; and upon this point it may suffice to quote a single passage to show that the expression was considered as equivalent to being seized with asthma, for we find the terms "asthmatici," and "anhelosi," used even by Galen, as synonymous or convertible.⁸ As to the term "stertor," which is not sanctioned by any classical authority, it is perhaps equivalent to stridulous breathing, Cornarius, in his translation of Galen's book, "*De difficultate respirationis,*" lib. iii. cap. 7,

⁶ Ibid. p. 226. Quoted at large in the Essay, p. 129.

⁷ *De Morbis Acutis Infantum*, p. 26.

⁸ Qui citra febrem dense respirant, qualiter faciunt qui velociter cucurrerunt, ab accessione hac Medicis Græcis Asthmatici, Latinis anhelosi appellantur.—*De Compos. Medicament.* Lib. vii. cap. 6.

rendering the Greek expression *κερχυρδεες*, (which has reference to a harsh grating and probably acute sound, rather than snoring,) by what he considers the parallel phrase in the Latin “stertorosi;” a phrase used, as we have already seen, by Etmuller, who was nearly contemporaneous with Harris, in the same sense, as implying the stridulous inspiration which is characteristic of hooping cough.

Hoffman notices asthma amongst the diseases which result from inflammation of the gums in painful dentition,⁹ and in a subsequent chapter, “de aliis infantum morbis,” he alludes to coughs of a strangling character with excessive difficulty of breathing and fear of suffocation, and occasionally epidemic. This might indeed be supposed to be merely the hooping cough, were it not that he has devoted a separate dissertation to the latter disease, and refers to Willis and Etmuller,¹ as his authority for applying to it the name of *tussis convulsiva*, which, according to him, may occur at any period of life, although it is more common during the tender age of infancy or childhood. But to the strangling cough, before alluded to as a disease exclusively of infantile life, (often mistaken for hooping cough, and confounded with croup,) he gives the very appropriate designation of “*tussis ferina vel furibunda*.”² Hoffman is, moreover, the first writer, as far as I have been able to ascertain, who has mentioned a connexion, of which I have given more than one instance, and have seen several, between the “*asthma suffocativum*” of children and certain eruptions upon the surface, amongst which he particularizes *tinea capitis*, and *crusta lactea*.³

⁹ Dolor hic vehemens gingivarum inflammationi conjunctus, febrem acutam, motus convulsivos, et epilepsiam facile accendit, *pavorem quoque in somno, vigilias, vomitus, diarrhoeas, asthmata excitat.*—*Prax. Clin. Morb. Infant*, cap. 4.—*De Pathem. de Dentitione Difficili*, §. 2.

¹ Primus ni fallor Willisius nomen illud rei apprime conveniens imposuit; cujus exemplum Etmullerus, alique clari viri, secuti sunt.—*Dissert. Med. de Tussi Convulsion.* §. 3.

² Tussis sæpe ferina et sicca infantes exercet, cum magna respirandi difficultate et suffocationis metu, et epidemice sæpe grassatur.—*Prax. Clin. Morb. Infant.* cap. 6. *De aliis Infantum Morbis*, §. 2.

³ Asthma quasi suffocativum fit vel ab inflatione nimia ventriculi, ob lac viscidum ibi copiose stagnans diaphragmatis expansionem impediende: quandoque

Some have supposed that Dr. Starr, a Cornish practitioner of considerable eminence, described the laryngismus stridulus of infants under the formidable designation of the "morbus strangulatorius." A perusal, however, of his paper in the Philosophical Transactions can scarcely fail to leave the impression, that he has confounded several diseases of very severe character, the result of atmospheric influence upon unhealthy subjects or individuals weakened by the peculiarity of the season. Amongst these complaints, there are distinct traces of cynanche tonsillaris, parotidæa, and trachealis, of enlargement of the other salivary glands—the submaxillary and sublingual—and such obstruction of the absorbent glands of the neck as to cause, by the "internal tumour," a "large œdematous swelling of the subcutaneous and cellular tissue from the chin down to the thyroid gland, and up the side of the jaw." Amongst the symptoms he enumerates "a short, low, heaving, hoarse cough, producing, sooner or later, a difficult, noisy, and strangulating respiration," and these last he "esteems as the pathognomonic symptoms of the real morbus strangulatorius." From the respiration, "*howsoever agonizing,*" having remissions and exacerbations, he infers that "its cause cannot of course be permanent," and he refers it therefore to an occasional "lodgement of some matter in or about the larynx and glottis, through which the inspired air is obliged to pass;" and he adds, that "while this matter is capable of being expectorated, and happens to be coughed off, the breathing for a time becomes free, and the patient is delivered from the utmost seeming distress; but upon its recurrence, which usually takes place, the patient either dies suddenly, or sinks gradually, or expires in convulsions." That some of the cases recorded by Dr. Starr were unequivocal instances of cynanche trachealis or croup, admits not of question;—this was proved by the portions of membrane in one case, believed by him to be the lining membrane of the

etiam hoc asthma spasmodicum est et ab repulsa e peripheria corporis ad interiora materia excrementitia acri in purpura, tinea capitis, erysipelate, vel crusta lactea fit, vel etiam ex eo habet quod respirationis nervi tenduntur per consensum in dolorificâ dentitione,—Ibid. §. 3.

whole trachea and bifurcation of the bronchi, which the patient expectorated; but that the whole of his description of the symptoms is applicable to that disease is extremely doubtful, for "pustules in the groins and about the anus, eating quick and deep and threatening mortification," the occurrence of "petechiæ," "swellings of the tonsils, parotids, submaxillary and sublingual glands," "internal tumours" producing "œdematous swelling of the neck," and "gangrenous sloughs of the mouth," all which are enumerated as the symptoms of the disease, have clearly no essential connexion with croup; and it appears to me no great stretch of imagination to suppose that in this prevalence of glandular disease or of ailments likely to influence injuriously the cervical absorbent glands, these may have become enlarged and produced the laryngismus stridulus, as the sole original affection in some instances, and in others accompanying and modifying the symptoms of some other disease so as to produce the "pathognomonic symptoms, "a difficult, noisy, and strangulating respiration;"⁴—a conclusion which derives further countenance from the occurrence of occasional attacks of agonizing respiration, with exacerbations and remissions, (like that which is the result of the lodgment of a foreign body in the larynx or glottis,) as well as from the "sudden death," with or without "convulsions," by which the children attacked were often carried off upon the recurrence of the fits of difficult breathing.

To Dr. Russell, also, has been ascribed a knowledge of the acute asthma, which he is represented to have described under the denomination of the angina inflammatoria of infants. Such at least was the opinion of Dr. Haygarth.⁵ In some particulars there is great resemblance, and, were it not for the "redness at the back of the palate and of the epiglottis," the affection of the tonsils in some cases," "the little creeping ulcers which spread about the larynx and alter the voice," and "the occurrence of fever," I should have little hesitation

⁴ Phil. Tr. 1749.

⁵ Letter to Dr. Smith, published by Dr. Millar in Rush's letter to the latter on the spasmodic asthma of children.

in pronouncing for the affirmative of their identity. These constitute strong circumstances of distinction and difference ; but striking features of similitude will also be found in the distinct remissions, and in the rest of the history of the disease ; for, “ upon every fresh access the respiration becomes very short and difficult, the child is forced to sit up erect in its bed, or get up ; when it cries, it is very hoarse, but often makes, upon every inspiration, a shrill, skreaking, or clangose sound, and if it is not instantly relieved by nature or art, must die.”⁶ This latter enumeration of symptoms leads one to believe that the disease, which they characterise, was the constriction or spasm of the glottis of recent writers, the asthma, the catarrhus suffocativus, or the suffocatio convulsiva of others ; but the redness of the pharynx, of the tonsils, and the creeping ulcers, are just different kinds and degree of sore-throat, the common result of some epidemic constitution of atmosphere very prevalent at the time, and obviously confounded, in description, with another complaint, probably the laryngismus stridulus.

In 1761 Dr. James Simpson published an inaugural dissertation quoted by Millar “ de asthmate infantum spasmodico,” which he describes as a malady occurring at the commencement of teething, as liable to recur at all periods until the completion of that process, as consisting of the most violent (atroces) paroxysms of asthma, accompanied with a shrill sound, (cum clangore surdo—the clangose sound of Russel ?), as occasionally destroying the patient in a single attack, otherwise remitting and very apt to be reproduced by any violent agitation of the body, such as laughing or coughing, and as continuing its course *without cough*, or, if any, very slight and dry.

Lieutaud was familiar with a disease which he denominates the “ catarrhus suffocans,” and which is similar to, perhaps identical with, that so commonly described under the title of the Asthma of Infants. He divides it into two species, one arising from a spasmodic constriction of the glottis, the other

⁶ Economy of Nature in acute and chronic diseases of the glands. Lond. 1775, p. 72.

from a clogged state of the bronchi. Both kinds, he says, may exist in various degrees, of which even the slightest are by no means devoid of danger; whilst the more severe frequently end in *sudden suffocation, with a coughing and wheezing* in the *breathing*, and, not unfrequently, *impaired sensibility*. In the first species the larynx is distressingly convulsed, and consequently constricted, the patient being threatened with immediate suffocation, as if from an extraneous substance sticking in the air tube, the head becoming afterwards sympathetically affected. Both kinds, he adds, rarely last above a few hours, and very frequently prove fatal; and both often escape the observation of the practitioner, although they are more frequent than is commonly believed, because they commonly attack the patient *in the middle of the night, and run their course before the medical man can reach them*; whence it is that, in the absence of medical aid, these miserable sufferers are often carried off by sudden death.⁷

⁷ A duplici causâ ortum mutuari catarrhum suffocativum credere par est; ab spasmodica scilicet glottidis constrictione et a bronchiorum infarctu. . . . Utraque diversis gradibus submittitur quorum leviores periculo minime vacant; e gravioribus vero emergit subitanea suffocatio, roncho et sibilo stipata; sensationibus plerumque deficientibus. Sub ineunte prima specie larynx moleste vellicatur et dein coarctatur, imminente suffocatione, non secus ac à bolo huc elapso; postea sensorium commune in consensum trahitur.—*Syn. Univ. Prax. Medic. Amstel.* 1765. vol. i. p. 166. Some may, perhaps, doubt whether the expression “roncho et sibilo stipata” has been properly rendered in the text,—and hence I have thought it more prudent to transcribe the whole passage. The ordinary signification of the original word *ρόγχος* is, perhaps, snoring, but that this is not the sense in which Lieutaud employs it is clear from his using, upon another occasion, the term “stertor,” to denote the snoring or stertorous respiration of other diseases. His exact meaning is, perhaps, after all, obscure, nor is the definition of the term by Cælius Aurelianus, who calls it a “stridor gutturis quem Græci *ρόγχον* vocant,” altogether calculated to remove the difficulty, excepting that the term stridor, generally implies an acute sound, like the braying of an ass, or the sharpening of a saw. To the former sound, stridor and sibilus seem to have been indiscriminately applied: “Insequitur clamorque virum stridorque rudentum.” (*Virg.*) “Sibilus rudentum.” (*Cicero.*) “Stridor serrarum cum acuitur.” (*Cicero*) But it is unnecessary to pursue this inquiry further, as there is enough in the rest of the quotation to establish the identity of the disease, described by Lieutaud, with the asthma of preceding, the constriction of the glottis of more modern writers.

The next author of eminence, who has noticed this disease in a separate publication which has been a most prolific source of controversial discussion both in this country, and more especially, amongst continental writers, is Dr. John Millar.⁸ His opportunities of seeing this disease were very extensive, and he identifies it as the same malady with that described by Dr. Simpson, whose description he quotes. But so little was the complaint known to the profession when Millar published his account of it, that it became a complete stumbling-block to the pathologists and nosologists of his day, and has continued so even to our own times. The former, unable to recognise in the description any disease with which they were familiar, doubted his accuracy of observation, or his fidelity of narration; the latter, unable to comprehend the pathological essence or, even, the precise seat of the complaint, knew not in what niche of their nosological arrangements to place a malady, the symptoms of which he had at least minutely detailed. Even Cullen, with all his perspicuity, had, and expresses, his doubts upon the subject. To me, however, with the new lights with which a minute investigation of the nature of this disease has supplied me, there appears little difficulty in recognising, at least in the first stage of "Millar's asthma," the complaint which it is the purpose of these pages to elucidate, and which Dr. J. Clarke has denominated "a peculiar species of convulsion in infant children." Had any doubt upon a point, apparently so clear, still remained upon my mind, it would be effectually dispelled by a consideration of the interesting fact recorded with all the simplicity of truth, and, apparently, without suspicion of any closer alliance than mere coexistence or accidental combination, that, at the time of its prevalence, there was also a *marked disposition to glandular disease, especially about the neck*. Capuron entertains the same opinion as to the identity of these diseases, although Mr. North hesitates to assent to it without some modification and reservation, the grounds of which, however, he has omitted to explain.

⁸ Observations on the Asthma, and on the Hooping-cough. 1769.

Still, as some may not be satisfied with this simple avowal of my opinion, it may be right to point out the principal features in which a resemblance may be traced ; and first, the disease described by Millar occurred in an unhealthy situation, upon the borders of England and Scotland, where there was a prevalence of “ a deep clay soil, which retains the moisture long, and is, consequently, damp ; where low fever was apt to prevail ; in the autumn of 1755, after a summer when a great quantity of rain fell, the harvest was late and wet, and the grain much damaged,” and when, as a consequence of the combination of these circumstances, so little conducive to general health, there was great tendency to enlargement of the cervical absorbent glands. “ There prevailed a slow remittent fever, accompanied with a tumour on the neck, or under the jaw, of an indolent nature, hard, and incapable of suppuration.” Now, few circumstances have a more direct influence in producing this disease, together with scrofulous enlargement of glands with which it has an intimate connexion, than an unhealthy residence, especially when combined with a cold, damp season, and impoverished diet. 2ndly. The symptoms are well marked and highly characteristic. “ Children at play were sometimes seized, but it generally came on at night. A child who went to bed in perfect health, waked an hour or two afterwards in a fright, with his face much flushed, or sometimes with a livid colour, incapable of describing what he felt, breathing with much labour and with a convulsive motion of the belly, the returns of inspiration and expiration quickly succeeding each other in that particular sonorous manner, which is often observed in hysteric paroxysms. The child’s terror sometimes augmenting the disorder, he clung to the nurse, and, if he was not speedily relieved by coughing, belching, sneezing, vomiting, or purging, the suffocation increased, and he died in the paroxysm.”

“ But if any of these happened naturally, or was exerted by art, the paroxysm ceased, and the child seemed perfectly well, slept during the remainder of the night, and continued to breathe easily till the following morning, when, if not

sooner, he suffered a paroxysm more violent and of longer duration than the former. In very young children, if they were peevish, restless, and cried more than usual, a return of the disease might be expected."

Here the suddenness of the attack, the extreme difficulty of breathing, the peculiar sound in respiration, the terror, ("pavor nocturni, as they are called by Gardien and others,) the modes of relief, the paroxysmal character of the disease, the total cessation in the intervals, and the causes reproducing the fits, the same with those enumerated, without allusion to Millar, by more modern writers, especially Hamilton and Clarke, are points of analogy and resemblance, so numerous, striking, and conclusive, that they cannot escape even the most superficial observer. They appear to me abundantly sufficient to establish its identity with the laryngismus stridulus, or constriction of the glottis, and to exclude altogether the notion entertained by some, especially Vieusseux, Albers, Dugés, and others, of its sameness in essence with inflammatory croup.

It thus appears that in the particular locality, the character of the season when it prevailed, the nature of the diet, the co-existence of enlarged glands, the symptoms, the causes, and the termination of Millar's asthma, we may trace all the leading characteristics (with the exception of the carpo-pedal contractions, which are far from essential to the disease) of "the peculiar species of convulsion of infant children," described by Clarke and others, in which "at length, a strong expiration" takes place, a fit of crying generally succeeds, and the child, evidently exhausted, often falls asleep."⁹

In the second stage, we are told by Millar that "the difficulty of breathing became fixed and permanent, the child grew hoarse, and breathed with a croaking noise, so as to be heard at a considerable distance; the pulse now intermitted; it became so low as scarcely to be felt, and so quick that the pulsations could not be reckoned. The shoulders were raised at every inspiration, which was now performed with great agony; the stomach and belly swelled; a profuse sweat

⁹ Commentaries on the Diseases of Children, p. 87.

broke out upon the head, face, and breast, the extremities were cold, the countenance of a livid colour, the eyes hollow, and the lips, tongue, and throat dry and parched. The child had great thirst, but durst not drink ; as every attempt to swallow was attended with the danger of instant suffocation.”¹

It is not easy to reconcile the phenomena of this second stage of Millar’s asthma either with its first stage, or with the disease under consideration. Their uninterrupted character mark a permanent disease, and the author himself has done something in a subsequent part of his work to clear up this obscurity, and to obviate the difficulty, by comparing this second stage of the acute asthma with the disease described by Home,² which was, beyond all question, the inflammatory croup ; thus countenancing to a certain degree the animadversions of J. Christ. Albers, who does not hesitate to affirm that Millar had described no new disease, but had mistaken a malady which was neither more nor less than the “tracheitis infantum, vulgo, croup vocata” described by his uncle J. Abraham Albers, in his prize essay upon that complaint.

After the fullest consideration, therefore, which I have been able to give to this matter, I cannot divest my mind of the strong impression that the first and second stages of the complaint described by Millar were in reality different diseases ; the first consisting in a partial or total closing of the glottis from the influence of the indolent, “hard, and unsuppurating tumours of the neck or under the jaw” upon nerves which minister to the movements of that chink ; the second being the true cynanche trachealis or laryngea, the croup of Home and subsequent authors, but mistaken by Millar at the commencement, inefficiently treated, therefore, at a period when

¹ Millar on the Asthma, p. 20, 21.

² Dr. Home describes the latter stage of the asthma in his inquiry into the nature, cause, and cure of the croup, or suffocatio stridula, and has with great industry collected a variety of cases to illustrate the history of the disease ; but it seems probable, that he has seldom seen the first stage of it, since most of the symptoms which he relates are peculiar to the second, as are also the morbid appearances which he found in the body after death.—Ibid, p. 80.

remedies were likely to avail any thing in its cure, and consequently pursuing an uninterrupted course to its fatal termination, when "the patient either gradually sunk under this accumulated distress, or the violent convulsions which generally came on at this period of the disease put a speedier end to his sufferings." This explains the statement, that "the attention of the physician was absolutely necessary to this disease at its very first appearance, and in its latent intermitting stage, as it was in that period alone that the cure could be attempted with much hope of success;" the remedies, by which this was relieved, being both positively and negatively injurious in what Millar designates the second stage;—positively injurious by their too stimulant properties, and negatively, by their implying the omission of those more active measures which are calculated for its relief.

In the same year with Millar's book appeared, in the *Philadelphia Gazette*, Rush's brief account of this disease; and in the succeeding year he published his observations in the form of a letter, addressed to Dr. Millar,³ adopting the views of the latter, as to the essential nature of the ailment, and acknowledging in glowing terms his obligations to him for the knowledge of a method of treatment, which he had found universally efficacious; for he alleges that after employing his remedy "he never lost a patient."

In this short pamphlet, now become very scarce, he transcribed the description of the disease from Millar's book, and thus identifies the spasmodic, or convulsive asthma of which he speaks, with the first stage of Millar's "acute asthma." He, however, states more at large the foundation of his belief in its convulsive character, resting his conviction with respect to this point upon the suddenness of the attack, upon its periodical character, upon the benefit derived from antispasmodic medicines, and upon the absence of phlegm or hardened mucus in the trachea, which, with the bronchi, he had found, after a fatal termination of a case of this disease "in a sound and natural state." These were the circumstances which led Rush to the opinion, identical with

³ A Dissertation on the Spasmodic Asthma of Children in a letter to Millar, by Benjamin Rush M. D. London, 1770.

that of Millar, that this disease was in essence convulsive; and which, he thought, even justified the additional negative conclusion that Home's sentiments, as to the inflammatory nature of croup, were "ill-grounded." With the candour, however, characteristic of a great mind, Rush some years afterwards volunteered an acknowledgement of his error in adopting, too hastily and exclusively, this opinion. Equally satisfied that there was such a disease, as that described by Millar and himself, in which there were none of the phenomena of inflammation, in which the symptoms were of a spasmodic character, in which it was requisite to direct the remedial means to "the indication to take off spasm," in which "bleeding often did more harm than good," and in which "the chief dependance was to be placed in vomits, and the warm bath did service;" yet, notwithstanding his belief in all this, he felt called upon to acknowledge, as the result of his further observation and experience, that there was another form of stridulous breathing, the malady described by Home as croup, which, he was now convinced, required more active measures for its cure, was very fatal in its character, and exhibited, after death, the most unequivocal evidence of preceding inflammation. But the mind of this eminent writer, once unsettled, could not rest even upon this opinion, which he lived still more materially to modify; for in the last edition of his "Observations and Inquiries" he more than expresses doubts whether he may not have altogether erred in supposing that there existed, in reality, any such disease as the true "spasmodic or convulsive asthma of infants."

In the same year with Rush's letter to Millar was published Dr. Rutty's "chronological history of the weather and seasons, and of the prevailing diseases in Dublin," in which was noticed a disease similar to, or the same with, the asthma of Millar, Rush, and more ancient writers, although Dr. Molloy, who drew up the account, does not give it that name. "It is peculiar" he says "to children, and those chiefly of from a month to three, four, five, six, eight, or nine years old. They commonly for a day or two, or more, had a little hoarseness, sometimes a little cough; then in an instant they were siezed with a great suffocation, lasting a minute or

two, and their face became livid: they have frequent returns of these fits of suffocation like asthmatic persons. The said suffocation is ever followed by one symptom which continues till they die, viz. a prodigious rattling in the upper part of the aspera arteria, resembling that sound which attends colds, where there is phlegm that cannot be got up. It is scarce sensible when they are awake, but very great when they are asleep."

"The chief seat of the disease seem to be in the glottis, not far in the aspera arteria." "They have no thirst, nor do I perceive any quickness in their pulse." "Their death is generally sudden, and when least expected, the pulse being good a minute before." "Some have tumours behind the ears which mortify: many have a prodigious weeping behind the ears, which is highly corrosive."

"Evacuations of all kinds, frequent bleeding and severe blistering were of no service. Diaphoretics, when they produced perspiration, were the only useful remedies."

Such is the abstract, drawn up by Dr. Molloy, of the interesting history of a malady of infants which raged over an extensive district, including "the county of Wicklow, Carlow, Queen's County, Kilkenny, Cavan, Roscommon, Leitrim, Sligo, and perhaps many others, carrying off incredible numbers, and sometimes sweeping away the children of whole villages in a few days,"⁴ and in the symptoms of which may be readily recognised the laryngeal affection, so long known as the asthma, the laryngismus stridulus of Mason Good. It wants only the peculiar sound in inspiration to complete the catalogue of symptoms. The suddenness of the attacks of suffocation, their frequent return, the absence of fever, *the mucous rattle during sleep, never when awake*, the seat of the disease believed to be the glottis, the sudden death, the tumours and morbid secretion of an acrid corrosive character behind the ears, and the inefficiency of depletion, all point to that conclusion. The absence of the sonorous inspiration is not decisive against it; for this is not invariably, although it is very generally, an attendant upon the disease in very young

⁴ Chron. Hist. &c. p. 109.

infants ; and it is not, by any means, impossible that this symptom may have been rather omitted than overlooked, for unless something of the kind occurred, it is difficult to comprehend upon what evidence Dr. Rutty affirms that the *glottis* was the precise part affected. The peculiar sound is *one* great and principal proof that this chink is the seat of the malady ; and that it was present, in some of the cases at least, may be more than suspected from the analogy, subsequently drawn by Dr. Rutty himself, between this disease and the morbus strangulatorius of Starr ; for he distinctly asserts, that both agreed in their characteristic symptoms, “ the pathognomonic signs being a short, low, heaving cough, productive of a difficult, *noisy*, and strangulating respiration.”⁵

The disease described by Dr. Lionel Chalmers, under the appellation of suffocating catarrh, was also probably of this kind. He says, it seldom occurs after seven years of age, terminates fatally if left to itself, is without pain, difficulty of swallowing, or fever ; the child may run about as in health, but is obliged to stop at times in order to fetch his breath ; there is wheezing, which increases fast ; the breathing is performed with a rattling kind of noise ; a dreadful stifling soon ensues ; and the patients, not being longer able to keep up, fell down dead, as one may say, in the midst of their play. The remedies suggested are purgatives or emetics.

In a subsequent part of the same work he describes the nervous asthma or suffocatio stridula, as occurring mostly in children under seven years of age, generally during the prevalence of northerly winds, attacking at any time, but mostly towards evening or during sleep, and then suddenly ; and, “ although it may have been forming before, yet it has not been noticed unless the child has been hurried by passion or exercise.”

“ The symptoms are hoarseness, difficult breathing, the lungs expand and contract with a harsh rattling sound, like small bladders shaken together in a close place, but without the churning noise of phlegm. Should the child lie down but for a short time, he will start up suddenly from the danger of immediate suffocation and pant for air in a gasping

⁵ Ibid. p. 115.

and strenuous manner.—*It arises from spasmodical constriction on the organs of respiration.* The child is obliged to cough often, yet no mucus is discharged, because none is secreted. One case lasted a fortnight, *and was then cured by bark and antispasmodics.* Diaphoretics and emetics were also useful.

It may be remarked, with regard to both these accounts, that they want the stridulous inspiration of the laryngismus, but in the first the other symptoms are too characteristic to admit of doubt, and as to the second, the employment of the synonym, “*suffocatio stridula*,” is decisive as to its existence. I am much inclined, however, to the opinion that Chalmers, like his contemporaries Millar and Rush, had confounded two diseases having many symptoms in common, arising from similar exposure to the vicissitudes of season, but totally different in essential character, and requiring different treatment; one being the true inflammatory croup described with the greatest accuracy by Home, the other the asthma infantum of Millar, or the laryngismus stridulus.⁶

The brief account of the diagnostic signs of Millar’s asthma, by Michaelis, whose work has been very universally quoted, is not very satisfactory. He concedes that spasm may exist both in the inflammatory croup and in the asthma, and his principal distinction is founded upon the alleged facts, that the spasmodic symptoms only occur in the former in the more advanced stage of the complaint, whilst in the latter they constitute the primary as well as most prominent occurrence; that in the former they are mingled with inflammation and its consequences, in the latter not; that the former do not bear anodynes, but that these are of great utility in the latter; that in the former an adventitious membrane is formed, whilst in the latter it is never observed, though he acknowledges that this is no pathognomonic sign, because it is also sometimes absent in true croup; that convulsive asthma is sometimes fatal in a single attack, but not so in the inflammatory croup; that there are generally pain upon pressing the trachea, and stridulous voice in the former, but these are absent in the asthma;

⁶ On the Weather and Diseases of South Carolina, vol. ii. pp. 69, 76.

that in the former, at the beginning, the urine is red, turbid, and white; in the latter, thin and watery; that the pulse, in the beginning of the former, is hard, full, and inflammatory, afterwards becoming soft and weak, in the latter small, contracted, and betokening spasm (spasticus).⁷

In 1781, Mr. Moss, a practitioner at Liverpool, in an essay on the management and nursing of infants, amongst other complaints, described the asthma, as not distinguishable in essential points from the asthma of adults, as peculiarly prevalent in the sharp keen air of the district in which he resided, and as occurring more especially amongst the children of the poor, who inhabit damp and ill-ventilated cellars. He supposes that the disease, to which he alludes under the denomination of asthma, must have differed from the complaint described by Millar and Rush, simply because Cullen, in his allusion to their works in his nosology, had classed the acute asthma of the former, the spasmodic asthma of the latter, amongst the inflammations in his synopsis. From this Moss very naturally inferred that the disease, described by those authors, was essentially inflammatory, which he did not believe the asthma to be; and he had no opportunity of setting himself right, as he had "not seen either of the publications." Mr. Moss describes it as a kind of cough and difficulty of breathing, "which does not attack so severely as a common cough; nor does the child appear to have so much pain from the cough, yet appears stuffed, and as if he would be suffocated at each fit of coughing; and has a difficulty of breathing at other times, especially when he is tossed or harshly moved; in short, the appearances are every way the same as in a grown person with the asthma." The stridulous inspiration is here omitted, but this is by no means sufficient to establish any essential difference in kind of the disease, which I have seen both in its less severe, and in its most violent forms threatening suffocation, unattended with the sonorous

⁷ *De Angina Polyposa sive Membranaceas*, 1778, p. 117 et seq. Some may doubt whether the term "spasticus" has been correctly rendered in the text. It seems, however, to be the sense in which Michaelis generally employs this adjective, as in combination with "indoles," "affectiones," and "symptomata."

inspiration at one time, presenting it as a characteristic symptom at another. In the large majority of instances, however, it appears at some period or other of the progress of the complaint.

This description was much dilated upon by Dr. Herdman, whose account I insert here, because he may be considered rather as a commentator upon Moss, than as an original writer. After quoting largely from the essay of the latter, he proposes, in a triumphant manner, this inquiry with respect to the disease—"What is it then but asthma? the same in its nature with the disease so termed in the adult. It follows, therefore, that the proper treatment of asthma in the adult will throw light on the mode in which this affection should be treated in the infant." Herdman, then, taking Cullen's "first lines" as his text-book, applies the doctrines of that distinguished professor, with regard to the asthma of adults, to the disease called asthma in infants, and arrives at the following conclusions: 1st. That the disease consists in a spasmodic constriction of the bronchia or lungs; 2ndly. That cold, a commonly producing cause, should be sedulously avoided, and that an important part of the treatment consists in regulating the temperature of the child's chamber with thermometrical precision; 3rdly. That the doctrine, which ascribes this disease to plethora and turgescence of blood, is conjectural and "supposititious;" 4thly. That the practice of blood-letting is neither supported by the predisposing or exciting causes, nor by the symptoms, and that experience cannot be urged in its defence; 5thly. That the diet of the child, if not at the breast, should be thin, consisting of milk and water, and now and then a little veal tea, not thickened with bread; but that a good breast of milk is decidedly preferable to all other kinds of nourishment; and lastly, that "he should, in a word, have every thing that can invigorate the constitution, and should suffer the action of no deranging or debilitating power."⁸

Underwood was obviously aware of the existence of this

⁸ Herdman's Discourses on the Management of Infants and the Treatment of their Diseases. Lond. 1807, pp. 134—146.

disease, which he has briefly noticed in his chapter on inward fits; and he acknowledges with candour his obligation "to some gentlemen of great respectability and experience" for the information, "that there is really such a complaint as inward fits, and that it generally proves fatal;" but adds, "that he had frequently met with the symptoms." "Besides," he says, "a little blueness of the lips, and slight turning up of the eyes, often noticed by nurses, this complaint is described to me as attended with a peculiar sound of the voice, (somewhat like croup), and a very quick breathing at intervals; and is supposed to arise from a spasm of the stomach, lungs, or other vital organ; a complaint I have indeed too frequently seen, but certainly very different from that usually accounted inward fits. These symptoms are said frequently to attack the child in its sleep, and in their commencement will go off upon taking it up from its cradle. They are likewise observed to be induced by sucking or feeding, and to be increased upon any little exertion of body or transient surprise, and in this manner to recur for a length of time before they become alarming. The remedies proposed for the cure of this complaint are an emetic in the first attack, and afterwards volatiles and foetids; but, as it has been observed, not often to good effect." Such is the account given of this disease in the second edition of Underwood, published in 1789. I have not been able to procure a sight of the first edition in 1784, and am therefore not aware whether the author had then become acquainted with the disease. From the few observations, however, with which he has introduced his outline of the history of this malady, it is probable that he was not very familiar with it until after the publication of his first edition. At all events, Underwood evidently stands next in the order of succession in the train of authors upon the subject of this disease. In the subsequent editions of his work, he very materially modified his opinions, as to the fatal tendency of the disease: in that of 1811, for instance, the sixth edition, he says, "These symptoms, indeed, I have frequently met with, and, howsoever alarming their appearance, if they be not accompanied with any other, they have

fortunately turned out more favourably, than this complaint is reported to do. Hitherto, at least, I have succeeded in removing this extraordinary spasm in every instance, by treating it, as I before hinted, as a chronical croup, by administering different antispasmodics; assafoetida, ol. succini, tinct. fulig. musk, or cicuta being prescribed, as particular circumstances have indicated; and so far from its generally proving fatal, I have not been able to learn, by the most diligent inquiries, that any children so affected, excepting two out of the number I have attended, have been carried off suddenly, or by any thing resembling this complaint.⁹

By far the best account of this disease which I have met with in any foreign writer is that of Wichmann, who seems to have seen and recognized this complaint, as distinct from croup, at Hanover where he practised. "It is not," he says, "to be considered as a chronic disease, and it differs from other kinds of asthma in attacking infants exclusively." In the cases, which he saw, "the infants, immediately before the attack, enjoyed perfect health: their age was generally from two to seven, one only being still at the breast. There was no preceding vomiting or chilliness. It manifested itself in the form of catarrh without fever, so that children might rise from their bed, or even go out of the house, the first day. But soon there suddenly supervened a constriction of the chest with great distress and agitation, and rarely accompanied with cough. It was particularly distinguished from the complaints of the chest, to which it might otherwise have some analogy by hoarseness of voice and a peculiar noise in respiration, which indicated great distress in breathing, hollow, deep, and yet sonorous, so that it might be heard at three paces distance. The patients suffered nothing: there was no running at the nose; the tongue was dry." "The complaint," according to Wichmann, "might be distinguished from catarrh by the above-mentioned symptoms and by the intermissions; for after the infant had been in anguish for hours, it began to breathe easily; it could lie tranquilly upon its back; it would speak

⁹ Underwood on Diseases of Children. Edit. 6, 1811, vol. i. p. 51.

and recur to its little amusements, but with indifference. At length the disease would appear to take on the character of an ordinary catarrh, and to merit little attention. But we should not be deceived by such flattering appearances; for scarcely has the remission continued twelve, eighteen, or twenty-four hours, ere the feverishness returns, the difficulty of breathing returns with aggravated violence, and the pulse rises in force and frequency. Soon the infant is in the greatest danger; it is menaced with suffocation... If the complaint be treated with antiphlogistic, resolvent, and other similar remedies, the evil may diminish somewhat in intensity, the attacks may be even less violent, but they will be no less frequent.... The first case which Wichmann saw he did not understand any more than an older physician, who saw the case with him; they treated it as an inflammatory disease until the death of the child convinced them of their error. From that time he considered this spasmodic asthma as a purely nervous affection, and he combated it not exclusively, as Millar did, with assafoetida, but also with musk, which he thought very efficacious."

MM. Brewer and Delaroche, who give this account,¹ add that they had never seen Millar's asthma, but did not venture, therefore, to deny its existence; yet they greatly doubt whether it differs from croup in any thing but degree;² an opinion, however, which, advanced by those who had never seen the disease, is of little value compared with that of Wichmann himself, who had frequent opportunities of observing it.

Dreyssig also, in his work upon medical diagnosis, distinguishes the convulsive, or Millar's, asthma from croup, and he enumerates the following as the leading and characteristic features of the former; 1st. its suddenness of attack without previous warning, and commonly in the night; 2ndly, its not existing as an epidemic, but always as a sporadic disease; 3dly, the cough, when it occurs, being dry, and with-

¹ Bibliothèque Germanique, tom. ii. p. 128. 1794.

² Peut-être y a-t-il des cas où ces remissions sont plus marquées, et où l'affection inflammatoire est un peu moins vive; mais ces variétés dans le degré, ne sauroit constituer une différence spécifique. Ibid. p. 144.

out expectoration; 4thly, the absence of pain upon pressure in the course of the trachea, but instead of it a sense of constriction in the thorax; 5thly, the sound of the voice like that of the barking of a dog of some size; 6thly, the absence of fever; and 7thly, its convulsive character, and its yielding to antispasmodics, such as assafoetida and musk.³

In the appendix to Dr. Cheyne's essay on croup is an interesting example of this disease occurring in "a boy, twelve years of age, whose breathing was very difficult: it was attended with a sense of constriction at the larynx; the inspiration was frequent and croaking, and his voice was rough and harsh. His breathing was so alarmingly difficult, that, according to the custom of the common people, all the women living in the neighbourhood were assembled to witness his death, which was hourly expected." "Since the attack commenced, he once or twice, unexpectedly, became easy, and continued so for a quarter of an hour, and then the symptoms again returned in all their violence."

He was relieved by an emetic. "He was blistered, and he continued getting better under the use of a strong solution of assafoetida." "This," he adds, "I conceived to be a case of the acute asthma of Millar, and under this impression I treated it successfully as a spasmodic disease. I have never seen another instance of the disorder."⁴

That this was an instance of laryngismus is, I think, clear from the denomination given to it by Dr. Cheyne, from the locality of the child's residence,—Newhaven—then a small fishing hamlet situated very low and close to the sea, but now a fashionable bathing place near Edinburgh, from the period of its occurrence, from the distress in breathing unaccompanied with cough, and from the remedies to which it yielded. Whether it was connected with glandular disease cannot now be known; but, at least, it occurred in a district, which has certainly no immunity from scrofula, and, as this is the most common cause of the disease at that age, it is not improbable.

³ Handbuch der Medicinischen Diagnostik, 1801. Band. i. p. 149.

⁴ Essays on the Diseases of Children, by John Cheyne, M.D. Edin. 1801.

M. Baumes has described this disease in a chapter "*Du cochemar et de la suffocation* ;"⁵ but, as he borrows his account principally from Millar, it is unnecessary to transcribe his details. I mention his account merely because it has been frequently quoted by writers upon croup.

Dr. Burns has devoted a portion of his chapter upon "croup" to a consideration of this complaint ; and as the first edition of his "*Principles of Midwifery*," appeared in 1809, and his "*Popular Directions*," in 1811, he is next amongst British writers who have noticed this disease. "During dentition," he says, "infants are subject to a spasm about the windpipe, which is very sudden in its attack, and is attended with a temporary feeling of suffocation and a consequent crowing inspiration ; but there is no hoarse or croupy cough, and in other respects the child is quite well. It is apt to come on from crying, or from awaking suddenly, or from any cause which hurries, or at all affects, the respiration. It may be combined with convulsions. The gums ought to be early cut, the bowels kept open, and, if the attacks are frequent, a combination of tincture of hyosyamus and assafoetida will be useful, and the throat rubbed with a little laudanum or camphorated spirits of wine, or anodyne balsam. The warm bath is serviceable."⁶ Such is the account given of this disease by Dr. Burns in his "*Popular Directions*," and his description even in the earlier editions of his "*Principles*," is nearly similar. In his edition, however, of 1820, he indulges in a very shrewd speculation that this "spasm about the windpipe" may sometimes arise from a paralytic condition of the respiratory nerves, but without tracing the existence of any cause capable of producing this paralysis, and without applying his doctrine to the explanation of the phenomena. It is a bold, ingenious, and singularly acute conjecture, which, if the results of my inquiries be well founded, has truth for its support. I have, however, some difficulty in understanding the distinction, rather hinted at than explained, between the spasmodic croup and

⁵ *Traité des Convulsions dans l'Enfance*. 1805. p. 410.

⁶ *Popular Directions for the Treatment of the Diseases of Women and Children*, 1811, p. 234.

the spasm about the windpipe, excepting that the former is accompanied with cough more frequently than the latter, which is, also, more frequently connected with teething than the spasmodic croup. His account of the pathological essence of both is imperfect, referring the first to a contraction of the glottis, sometimes from spasm of its closing muscles, sometimes from a paralytic condition of their antagonists; the second being described, without sufficient regard to precision, as a "spasm about the windpipe."

Dr. James Hamilton, the present eloquent professor of midwifery in Edinburgh, has described this disease with such accuracy, that I cannot refrain from transcribing his account,⁷ which has been unaccountably overlooked by Dr Clarke and nearly all subsequent writers upon the subject. "The most formidable symptom," he says, "except convulsions, which occurs during dentition remains to be noticed. It is a kind of convulsive stricture of the upper part of the windpipe, producing a peculiar crowing sound, as if from suffocation. This affection is quite momentary, and generally happens on awakening from sleep, or taking drink or food, or on the infant being teased or irritated. Sometimes the fits are redoubled, but more often they are single. The disease is unaccompanied with fever or any material derangement of the general health. When cough attends, which is not always the case, it is not hoarse, and the breathing during the intervals is perfectly free. Those circumstances distinguish it from croup, which it resembles in the crowing sound."

"This complaint is of such rare occurrence, that it has been little attended to by practitioners, and has not been accurately described by any author. It has happened to the most robust, as well as the most delicate infants; and, as far as my observation enables me to judge, is peculiar to the period of cutting the deciduous teeth. It sometimes continues for

⁷ Hints for the Treatment of the principal Diseases of Infants and Children : at the end of the 7th edition, of a Treatise on the Management of Female Complaints, by Alexander Hamilton, M.D. 1813.

months, occasionally decreasing in violence, and suddenly again becoming aggravated, so that for a week or two the infant shall have forty or fifty attacks within the twenty-four hours, and then the number shall be diminished to eight or ten. The event to be dreaded is sudden suffocation, or a severe convulsion from which the infant cannot recover. In one case, this happened at the distance of five months from the first attack, and after the infant had seemed almost completely relieved from the disease.”⁸

In a subsequent part of the same work, Professor Hamilton alludes to the “spurious croup,” which he says is “very analogous to the asthma of grown people,” which “comes on suddenly, without any previous indisposition, in the form of very difficult breathing, occasioning fits of croupy coughing, unaccompanied with the appearance of tough phlegm in the throat or mouth,” “with little alteration of the countenance, and without that excessive agitation which is so strongly marked in the true croup.”

“This disease,” he adds, “attacks delicate much more than robust children, and occurs during any state of the weather. Its duration is, in general, limited to a few hours, and, in many instances, it ceases entirely for many hours, or even for a day or two, and then recurs; so that the child may have several attacks within a short time. There can be no doubt that the spurious croup has, upon some rare occasions, proved fatal; but in general it is unattended with danger. It seems to arise from a spasmodic affection of the windpipe.”⁹

In these two descriptions of diseases, supposed by Dr. Hamilton to be distinct, there is, I think, little difficulty in recognizing the same morbid affection somewhat modified by the agency of some circumstances, unnoticed by the learned professor, perhaps difficult or impossible to be traced. There is little difference, even in description, between the “convulsive stricture of the upper part of the windpipe” of the first, and the “spasmodic affection of the windpipe of the second;”

⁸ Hints, &c. p. 300.

⁹ Ibid. p. 365.

between the “momentary” attack of the first on awakening from sleep,” &c., and “the coming on suddenly without any previous warning” of the second; between “the peculiar crowing sound, as if from suffocation,” of the first, and “the very difficult breathing, occasioning fits of croupy coughing,” of the second; between the “absence of fever or of any material derangement of the general health” of the first, and “the little alteration of the countenance” of the second; between “the perfectly free breathing in the intervals” of the first, and “the duration limited to a few hours,” “the entire cessation, in many instances, for many hours, or even a day or two,” of the second; between the “forty or fifty attacks in the twenty-four hours” subsequently, perhaps, “diminished to eight or ten,” of the first, and the recurrence of the second, “so that a child may have several attacks within a short time.” These are points of resemblance so striking, as abundantly to establish some very near affinity betwixt the two diseases. I am, indeed, satisfied of their identity, having the additional evidence derived from pathological inquiries; for I have found them repeatedly to depend upon the same morbid alteration of structure, and have again and again noticed them in the same individual running by insensible degrees into, or succeeded by, or alternating with each other; sometimes attended “with croupy cough,” sometimes not; sometimes involving the hazard of life, when “the event to be dreaded is sudden suffocation, or a severe convulsion,” sometimes “unattended with danger.” Even Dr. Hamilton admits that cough may occur in both, although less frequent in the first, and the only other distinction between the two, founded upon the degree of danger, is evidently a difference rather of degree than of kind.

The account of this disease given by Richter, although referred to by Mr. Joy, of Dublin, is so obviously an imperfect abstract of that already quoted from Wichmann, that it is unnecessary to dwell upon it, further than to state that his account of the malady is too brief to be of great utility, and that his observations are directed to only two or three points in the diagnosis.¹

¹ Die Specielle Therapie. Band. vol. i. p. 472. 1813.

In the course of the same year with Professor Hamilton and Dr. A. G. Richter, M. Capuron² described this malady in his article “de la constriction spasmodique de la poitrine et du larynx;” but neither in compression, precision, nor accuracy, does his description exceed, or even equal, that which I have just quoted from Dr. Hamilton’s “Hints,” and he omits altogether the sonorous inspiration. All the other characters of the disease, however, are so distinctly delineated, that it is impossible not to recognise it as the same with that known to the older writers as the *asthma infantum*, and since described by numerous writers under various appellations, but more frequently noticed “as the peculiar species of convulsion described by the late Dr. Clarke,” whose account follows, in the order of time, that of M. Capuron.

Dr. Clarke, in his outline of this disease,³ has described the symptoms with great fidelity, and he is, I believe, the first writer who has noticed its association with a tonic contraction of the fingers, thumb, wrists, feet, and ankles, now well known under the very general designation of “carpo-pedal contractions.” He also announces a new view of the nature of the malady and of convulsions in general.⁴ There is, however, a want of clearness in this part of his subject, which is rarely observed in his writings, and which leaves one in doubt as to his precise meaning. The natural construction of his sentence would lead to this interpretation;—that he infers from the assumed dependance of this disease (which he believes to be convulsive) upon some disturbance of the cerebral circulation, that all convulsions have the same origin. I have reason, however, to think that most writers and practitioners read it differently, and that he intended to reason in the inverse order, deducing the dependance of this disease upon cerebral excitement or pressure from the fact alleged, but assumed

² *Traité des Maladies des Enfants, jusqu’à la Puberté.* 1813.

³ *Commentaries on some of the most important Diseases of Children.* 1815.

⁴ A long and very attentive consideration of this kind of convulsion has led the writer to conclude that in every case of convulsion, (be the remote cause whatsoever it may,) the brain is at the time originally affected, either directly or indirectly.—*Commentaries*, p. 90.

rather than proved, that other convulsions have universally that origin. Such, at all events, has been the deservedly high estimation in which the authority of this accomplished physician has been held, that the doctrine of some association between this disease as the effect, and an affection within the cranial cavity as its cause, has been generally adopted; whilst his practice has been too subserviently followed, and carried upon many occasions far beyond any thing which his writings, fairly interpreted, would sanction. But his theory is too exclusive, as well as too speculative, to be admitted without subjecting it to a more rigorous examination than it has hitherto encountered; and his remedies are of such energetic character, that if not imperiously demanded by the nature and urgency of the disease, they ought not to be had recourse to. Nothing can justify the employment of such violent expedients, but the most direct and conclusive evidence of their absolute necessity, as well as of their general efficiency.

Dr. Cheyne⁵ has noticed this malady as “another disease of infancy requiring to be briefly adverted to in treating of the diagnosis of hydrocephalus.” “This disease,” he says, “has been known to some authors under the titles of inward fits, chronic croup, &c. It begins with a crowing inspiration, like that which takes place in the commencement of a paroxysm of pertussis. As at first there are long intervals between these spasmodic inspirations, (several days perhaps,) as they appear to be connected with a disordered stomach and absence of bile in the bowels; to arise from sudden exertion or fits of passion; and, as the child often continues to thrive notwithstanding

⁵ *Essays on Hydrocephalus Acutus, or Water on the Brain.* 1819. I have before adverted to an example of this disease related in the appendix to Dr. Cheyne's *Essay on Croup*, and designated by him the *Acute Asthma of Millar*. The more elaborate and complete account, above quoted, did not appear in his first edition of the *essay on Hydrocephalus Acutus*, (1808,) but it seems to have been the result of subsequent observation between that period and the publication of his second edition. (1819.) It may be remarked, however, that, in the interval, Dr. Clarke's very accurate description of this complaint had become generally known to the profession, and, although Dr. Cheyne makes no allusion to this writer, yet his account could hardly have escaped him.

ing, the disease is not much attended to. At last, however, the spasmodic inspirations excite just alarm; they occur frequently without any apparent cause, when the child is perfectly tranquil; the complexion becomes purple, insensibility follows, and not unfrequently universal convulsion, or rigidity of the muscles with the thumbs clenched in the hand; these convulsions in seven instances, to my knowledge, have ended in death. However, after continuing many weeks, or even months, this affection often terminates favourably with the cutting of one or more of the teeth, or it may be relieved by effectually scarifying the gums, changing the air and diet, and alternating mercurials with carminative purgatives. The pathognomonic of this disease is *a crowing inspiration* with purple complexion, not followed by cough. In some cases, this affection is attended not merely with a permanent clenching of the hand upon the thumb, but also with a very remarkable fixed spasm of the toes, particularly the great toe, which gives a look of swelled deformity to the upper part of the foot.”⁶

It may be remarked with respect to this extract, that although it is embodied in a work professedly upon hydrocephalus, yet it does not appear that Dr. Cheyne believed in their identity. On the contrary, he considers it “requisite to advert to this peculiar affection as connected with the subject of diagnosis.” He does not mention it as a symptom of hydrocephalic disease in any of its stages, but as a symptom requiring to be distinguished from it; and, it is scarcely necessary for me to state a proposition so obvious, as that distinction implies rather a difference, than similarity or sameness. He represents indeed the disease, after repeated attacks, as having a tendency to be followed by insensibility, general convulsions, and even death; but Dr. Cheyne had obviously no suspicion even, that in its origin or its continuance for weeks or months it had any essential connexion with cerebral excitement, an idea which is altogether incompatible

⁶ Essays on Hydrocephalus, ed. 2, p. 16.

with either its duration or with the very simple but useful remedies to which, it has been seen, he entrusted its cure.

Golis, whose work upon the acute hydrocephalus is principally known to us through the translation of my late estimable friend and colleague, in whose untimely loss the profession has much to deplore, considers this complaint as one of the predisposing causes of the "inflammatory water in the head." His account, which "displays a master of his art," to use an expression applied to him by the late Dr. Gooch, is this:—"Likewise belongs to the predisposing causes, injuries of the head in the birth; tight swaddling, impeding the freedom of circulation; a peculiar disorder of respiration in which infants, after sudden waking out of sleep, after terror or anger, often too without any cause, are suddenly seized with a deep shrill respiration for many seconds, sometimes even for minutes, threatening suffocation; the whole body becomes as stiff as a log of wood, the face, hands, and feet, particularly the toe-nails, black and blue, they lose their breath and consciousness, and at length, with a cry of alarm, recover their breath again."⁷

M. Gardien has noticed this disease, but there is much confusion in his account from an excess of refinement in his attempt to distinguish from each other diseases, which are not in reality different. So, in one part of his works, we find him describing as one of the accidents of teething "sudden frights awakening the child suddenly, and threatening convulsions, or even epilepsy;"⁸ in another, "a difficulty of breathing, with dry nervous cough coming in fits, from the same cause;"⁹ in a third is noticed "a cough from feebleness of the bronchi;"¹ in a fourth is described the "catarrhe suffocant," in which, without manifest cause, the infant is all at once considerably relieved, the respiration becomes almost

⁷ A Treatise on the Hydrocephalus Acutus, by Leopold Anthony Golis. Translated by Robert Gooch, M. D., 1821. p. 71.

⁸ *Traité complet d'Accouchemens*, vol. iv. p. 215. Ed. 3. 1824.

⁹ *Ibid.* 216.

¹ *Ibid.* 291.

natural, the patient can get out of his bed and walk, but after some time, in the midst of our best hopes, at a moment when we are little attentive to the patient, there occurs a paroxysm which carries off the child ;² in a fifth is mentioned, as distinct from, but sometimes confounded with, the catarrhe suffocant, “ a sudden suffocation produced by a convulsion of the muscles of the thorax, or by a spasmodic constriction of the glottis,” to which M. Mauciers proposed to give the name of “ catarrhe suffocant nerveux ;”³ and lastly, he devotes a separate chapter to the “ nightmare, and a spasmodic affection of the chest and glottis, to which infants are liable.”⁴ Many, if not the whole of these ailments, are similar, perhaps identical in kind, although they vary in degree ; and, by thus mentioning the same complaint under a variety of appellations, M. Gardien has exposed himself to his own reproach ; for, “ la multiplicité des noms sous lesquels elle a été décrite par les auteurs a jeté beaucoup de confusion dans son étude.”

The alliance of this disease with nightmare, which M. Gardien considers as the precursor, or rather the first degree of the spasmodic affection of the chest and larynx, would at the first glance appear rather fanciful than real ; and yet there is some foundation for the association. Nightmare is a sudden interruption to the breathing, commonly from indigestion and consequent distention of stomach, and attended with a closing of the glottis ; in this disease, from a combination of causes, the stomach and bowels are very apt, in the emphatic language of Millar, to be “ inflated,” and such distention is constantly the precursor and cause of a paroxysm. He represents both as attacking children generally in their first sleep, the nightmare, however, occurring most commonly in children at the breast,—the spasm of the thorax and glottis not till the age of from two to seven ; and yet with an inconsistency, not very easily reconciled, it is stated in the same paragraph that infants are very liable to the “ cauchemar” during dentition, and that the fits have often been described under the desig-

² *Traité complet d' Accouchemens*, vol. iv. p. 293. Ed. 3. 1824.

³ *Ibid.* p. 311.

⁴ *Ibid.* p. 376.

nation of the "*pavores nocturni*." The attack having passed away, the infant again goes to sleep, to be attacked on the following evening, and commonly with the same severity at the same hour.

If this affection be unnoticed, or unyielding, it assumes a more severe form, becoming the "spasmodic affection of the chest and larynx," which, in one place, he represents as having relation to, in another as identical with, the acute asthma of Millar. This, he also says, generally attacks suddenly, and almost always during the first hours of the night; it occurs generally between the ages of two and seven; the difficulty of respiration is extreme, is accompanied with a "râlement, which one may hear at some distance," and, in some instances, appears to cease almost entirely. "This paroxysm may terminate fatally by suffocation, unless the child be relieved by belching or vomiting. The disease has intermissions more or less strongly marked; but the attacks return with violence, and are often preceded by convulsive movements of the chest, extending to the epigastrium, and even to the superior extremities. The duration of this spasmodic affection is not commonly longer than two hours, and, when fatal, death is much more sudden than either in croup or the "catarrhe suffocant." "If proper remedies are not employed in the first paroxysm, there is little hope of saving the child, and the danger is greater from the attacks generally occurring in the night, when immediate medical aid cannot be obtained, and because the nature of the disease is often misunderstood."

As to the treatment, Gardien rather enumerates the remedies of others, than suggests his own expedients. "Under whatever designation," he says, "this disease may have been described, all recommend the use of narcotics and antispasmodics." He quotes Gregory in favour of opium, Wichmann of musk, Millar, Chalmers, and Thompson of assafoetida, Odier of flowers of zinc, Rush and Ramsay of calomel, Dobson of external friction with mercurial ointment, and the only additional measure, which he suggests, consists in the application of a blister, "with a view to produce a revulsion which shall get rid of a fixed spasm." The only recommendation

of this account of remedies is its conciseness ; but it is clear that M. Gardien, in his anxiety to omit nothing, has inserted in his catalogue the remedies for the inflammatory croup, as well as for the disease which he believed to be essentially spasmodic.

Of late years this complaint has become much more generally known, and interesting examples, together with observations arising out of the circumstances of each case, are occasionally to be found in the medical periodical journals. Amongst these I would mention with approbation a communication by Mr. Pretty,⁵ who has been but too painfully interested in this disease ; one by Dr. Henry Davies,⁶ who has recorded the dissection of a fatal case ; and the observations of Mr. North, afterwards collected and remodelled in his work “ upon the convulsions of infants.” The two former writers, however, have been, perhaps, somewhat precipitate in their adoption of the speculative views of Dr. Clarke, as to the dependance of this disease upon vascular congestion within the head ; whilst the last, who, when he first communicated his sentiments to the public, had never seen it terminate unfavourably, denied the connexion altogether, and combated with much success the Herculean attacks too indiscriminately made at once upon the disease and upon the constitution. Mr. North⁷ has since, in his “ Observations,” with the candour of an ingenuous mind, modified his first statement as to the universally slight character of this complaint. He acknowledges that it may be occasionally fatal, though much less so than has been generally believed ; and he mentions one instance in which it destroyed the patient, and in which were discovered after death evidences of head-affection ; but he still denounces, in energetic terms, the heroic remedies so generally employed.

M. Gervino⁸ confounds this disease, with which he was evidently familiar, with the croup, of which, it is clear, he knew nothing but from the descriptions of others, and in all proba-

⁵ Lon. Med. and Phys. Journ. vol. lv.

⁶ Lon. Med. Repository, vol. xviii.

⁷ Practical Obs. on the Convulsions of Infants, p. 253. 1826.

⁸ A Treatise on the principal Diseases of Children, &c. p. 263. 1829.

bility from the writers of France and Germany, who have been particularly prone to the commission of the same error. He says, "it generally comes on in the night. The child is most frequently awakened by frightful dreams, with such a difficulty of breathing that he seems nearly suffocated. Very young infants are cut off by it generally before it is perceived that they are ill. Children from three to seven years old, (a period in which the croup most frequently occurs) suddenly awaking, sit up in their beds in a state of trouble and distress: the breathing is extremely difficult, frequent, short, wheezing, and hurried, sometimes accompanied with a croaking cough; the face becomes red, the look wild, and the eyeballs so prominent, that they appear to start out of their sockets: and the pulse quick and irregular. By the application of some warm linen to the breast the paroxysm will presently subside, the child will go to sleep again, and awake the following morning as healthy as he was before."

That the complaint thus noticed by Gervino could not have been true "croup," although he so designates it, is definitively established by the effects of his remedies; for no one can for an instant believe, that so severe a malady, as the active, inflammatory croup, could be cured by the application of a warm cloth to the chest, or would have been intrusted by this learned professor to such means; or if temporary relief had been obtained by such an application, or even "by applying to the stomach and round the neck fomentations of warm milk," which he also recommends, still it would be too much to expect that "the child could go to sleep again, and awake the following morning as healthy as he was before."

Wedded to his peculiar notions, Gervino referred this disease, as well as scrofula, to the existence of worms in the alimentary canal; and after the paroxysm has subsided or been subdued, he advises, for the permanent cure, a trial of anthelmintics; but the love of system has not impaired his faculty of observation, as is obvious from a description, in which it is impossible not to recognise one of the forms of the disease, I have been engaged in describing; that in which the respiration is for a while completely suspended, and the child conse-

quently in a state, which modern writers, without much attention to etymological precision, denominate asphyxia. It proves also the existence, if not prevalence, of this complaint, in a locality much infested with glandular disease, the valleys of Piedmont where Gervino practised; and this probably arising from a dampness of soil and situation, which, among other articles of commerce, enables the inhabitants to grow and export rice as one of their staple commodities and productions.

In Dr. Gooch's Lectures, edited by Mr. Skinner, (p. 338) this disease is noticed under the quaint but appropriate designation of "*child-crowing*;" he describes it as, probably, an affection of the brain, of fatal tendency, destroying one-third of those attacked, in which, as far as he knew, "all medical treatment is unavailing, and in which the essential treatment should consist in attending to the functions of the digestive organs, in giving antispasmodics, in obviating congestion about the head by bleeding, &c., and in sending the children out of town into a mild and healthful atmosphere."

Amongst the last, as well as decidedly the best, practical essays upon the subject of this disease, I cannot omit to mention that of Dr. Marsh, of Dublin, who has pointed out from his own experience and observation, with much more clearness and precision than any preceding author, its symptoms; has traced with a masterly hand its more simple forms, and noticed its complications with other maladies; has observed and noted its intimate connexion with struma as its cause; and has strenuously recommended a mode of treatment much more calculated to restore the feeble constitution of these children, and permanently to cure their malady, than had hitherto been adopted.⁹

In a work too of very unequal interest and merit, the "Cyclopædia of Practical Medicine," is an article upon "Spasm of the Glottis," by Mr. Joy, which, without much pretension to originality, either of thought or expression, has still the merit of being, upon the whole, a judicious selection from the writings of others. He has drawn largely from the

⁹ Dublin Hospital Reports, vol. v.

paper of Dr. Marsh, of which I have had occasion to speak in terms of high commendation.

Since the publication of the series of papers upon this disease, which, in the early part of the last year obtained admission into the columns of the Medical Gazette,¹ Mr. Robertson, of Manchester, has related some interesting examples of this disease, which occurred within his own observation. He has expressed doubts of the accuracy of my conclusions with respect to the pathological nature of this complaint. Having, however, made something like a conditional admission of their truth, if I would point out 'analogous effects from similar causes in other parts of the body,'² I trust, that in my reply to him,³ I have fulfilled his conditions, vindicated the truth of my opinions, and procured his suffrage in their support.

I have thus traced this disease in a continuous stream of authorities from the age of the father of rational physic down to our own times. The descriptions by the writers of this country are commonly more perspicuous and exact, than we find them in the works of foreign authors. This has, in all probability, arisen from the greater frequency both of the laryngismus and of croup in the crowded cities and large manufacturing towns of this country, than in the less variable climate, the more salubrious air, and healthful occupations upon the continent. There, many of the most judicious writers, (amongst whom is M. Albers, of Bremen, a successful competitor for the prize offered by Napoleon for the best essay upon croup, and who acknowledges that he had never seen Millar's asthma,) having met with few opportunities of personally observing the laryngismus, have contented themselves with collecting the opinions and statements of others, especially those of Millar, that they might use them in controversial discussion as to the existence of such a disease. It must have been, also, from the comparative unfrequency of the complaint in France that the accounts of the disease in the medical records of that country are so few, meagre, and unsatisfactory.⁴ One writer

¹ Medical Gazette, vol. xiii.

² Ibid. p. 970.

³ Ibid, vol. xiv.

⁴ Cette maladie, l'asthme aigu des enfans sans se présenter fréquemment n'est cependant pas très rare; et lorsque les médecins anglais, allemands, suédois

of considerable eminence, in a work which, as it is now in the course of publication, may be considered as representing the state of medical opinion in France at the present time,⁵ speaking of the asthma of Millar, denominates it "*une maladie problématique*;"⁶ whilst another in the same collection admits its existence, believes it to bear no analogy to croup, to be in essence the same as the asthma of adults, and to be the result of spasm of the glottis and bronchial tubes.⁷ But whether we consider the quantity or quality of evidence upon this subject, the preponderance is immensely in favour of the existence, amongst children, of a peculiar malady, having, in some respects, a resemblance to croup, although essentially distinct and requiring a total difference of treatment. The affirmative of this has in its support a host of authorities, including Hippocrates, Galen, Coelius Aurelianus, Etmuller, Lieutaud, Millar, Rush, Chalmers, Russel, Ferriar, Field, Leeson, Wichmann, Dreyssig, Michaëlis, Girtanner, Moss, Herdman, Underwood, Cheyne, Hamilton, Burns, Clarke, Double, Royer-Collard, Jurine, Gardien, Capuron, Richter, Lobstein, Cailleau, Guersent, Jolly, Golis, Davies, Pretty, North, Gooch, Marsh, Joy, Robertson, and perhaps others, whom I may have omitted in my enumeration.

Even those, who advocate a contrary opinion, find much difficulty and embarrassment in explaining the circumstances of particular cases, which may have occasionally presented themselves to their notice. So, M. Valentin, after a long and elaborate discussion, occupying about twenty pages, concerning the diagnosis between Millar's asthma and croup, in which he has borrowed largely from Wichmann, Dreyssig, and, perhaps, Double, comes to the extraordinary conclusion that they are the same diseases, both essentially inflammatory, and varying only in the degree in which the symptoms of

et Italiens en ont recueilli des cas assez nombreux, et qu'ils en ont publié même plusieurs traités, il est étonnant sans doute qu'il n'existe pas, du moins à notre connaissance, une seule observation détaillée de cette maladie parmi les médecins français.—*Traité du Croup*, par F. J. Double, p. 423.

⁵ Dict. de Méd. et Chir. Prat.

⁶ Dugès in verbo Croup.

⁷ Jolly in verbo "Asthme."

spasm may be combined with the original affection.⁸ In several of the examples, however, recorded by M. Valentin, there is no evidence whatever of the existence of inflammation; and the last, the 12th of his series, was clearly an instance of laryngismus, in which cough, only once slightly and incidentally noticed, appears scarcely to have occurred from its commencement to its termination; in which there were complete intermissions; in which the attack is described as “un accès de suffocation avec sifflemens et des mouvemens convulsifs;” and in which at one time the child was in danger of suffocation, at another it *was tranquil and the breathing free*. In some of the other instances related by him, as illustrations of croup, the disease was more allied to laryngismus, particularly the first, the account of which he concludes by an acknowledgment that the paroxysms of the disease were periodical.⁹ In his second, the enlargement of the thyroid and thymus glands, succeeding measles, offers a more satisfactory explanation of the symptoms, than the supposition that it was croup, notwithstanding the puriform, greyish, frothy, pulpy, sticky expectoration, and slight appearance of “phlogose” on the epiglottis and side of the larynx;—for “the membrane of the trachea was in a natural condition.”¹ His third case, one of “suffocative cough with sibilous respiration,” could scarcely have been croup, for excepting greyish tough phlegm, there was no inflammatory appearance, the lining membrane of the trachea and larynx being even *whiter than usual*.² The sixth case was one of “suffocation *with slight cough*, no fever, and with two short remissions,”—on the third and fourth days the child had very alarming paroxysms of suffocation, and was well on the fifth day; but these are hardly the symptoms, or course of true croup, in which Valentin himself describes

⁸ “La prédominance des symptômes nerveux, dans la plupart des cas, ne caractérise point une différence essentielle, ou ne constitue pas une maladie spécifique, mais seulement une variété.—*Recherches sur le Croup*, p. 332.

⁹ Ainsi, les trois violens paroxysmes de ce croup, que nous méconnaissions alors, ont suivi un cours périodique.—*Ibid.* p. 118.

¹ *Ib.* p. 120.

² Il n’y a nulle trace de phlogose. La membrane muqueuse de la trachée et du larynx paraît même plus blanche que dans l’état naturel. *Ib.* p. 121.

the cough as generally preceding the attack for days, then violent, and coming in fits like that of whooping-cough.³ His seventh case, under the care of Drs. Taylor and Hansfort, in Virginia, appeared, even to the author himself, to be like an attack of "the acute suffocative asthma, described by Millar," and was probably such.⁴ The nature of the eighth case is doubtful, but approaches nearer in its character to, what has been called, spasmodic, than to inflammatory croup.⁵ The ninth case was one apparently of laryngismus about fifteen days subsequently to the cure of a scabby eruption about the head and ears, and immediately after exposure in a marshy situation to a very cold wind; the prominent symptoms being the attacks of breathlessness.⁶ After death there was great accumulation of tough phlegm in the bronchi; "the mucous membrane of the larynx was white, with a slight tint of dusky red near the bronchi."⁷

It thus appears that many of M. Valentin's cases would not, in this country, where we are familiar with both diseases, be considered as instances of inflammatory croup, for this, amongst other reasons; that where an opportunity was afforded of examining the body, the membrane was found to be not inflamed, and in one instance *even paler than usual*; and although this may not have been observed in the majority of the instances recorded, some of which were unquestionably legitimate cases of croup, yet they are sufficient to vitiate his general conclusion, that the true inflammatory croup and Millar's asthma are but varieties of the same disease.

Similar observations will apply to the opinions and cases of M. Desrouelles.⁸ His first example contains an admirable description of the laryngismus, but has not the character of croup. The child had laboured under whooping-cough six months before, after which, on the 18th of February, it was seized with *slight cough*, accompanied with difficulty of

³ Ib. p. 171.

⁴ Ib. p. 128.

⁵ Ib. p. 131.

⁶ Ce qui l'étranglait, et l'empêchait de respirer. Ib. p. 132.

⁷ Ib. p. 134.

⁸ Traité Théorique et Pratique du Croup, par H. M. J. Desrouelles, 1824.

breathing and some convulsive movements. In the course of the night of the 19th and 20th it had another attack. On the 20th, at nine in the morning, it became the victim of a fearful attack of croup. The neck was swollen and red, the face livid, the head thrown forcibly backwards, the suffocation imminent, the pulse scarcely perceptible. The child made great efforts to respire, (just as occurred in the animal with the recurrences divided, in the experiment of Le Gallois, who uses nearly the same expressions in describing the phenomena which presented themselves:⁹) the whole body was in a state of agitation; the muscles of the lips and face were convulsed, and rendered the countenance hideous. The air, upon its entrance and egress through the larynx, produced the croupal sound, which could be heard at a distance; it was sharp, shrill, and, being distinguished even before entering the chamber of the child, enabled M. Desrouelles to recognise the disease which he had to combat. On the 21st there was a complete remission, followed by a fresh attack on the morning of the 22nd; another at three in the afternoon of the 23rd, and on the 28th the child was convalescent; and although the child was so exhausted upon one occasion, in consequence of the loss of blood from leeches, that it was thought to be dead, yet it completely recovered during a sojourn in the country, and under the use of bitters. During the whole of this period cough is never mentioned a second time, and we may conclude therefore that it must have been absent. His second case¹ was similar in kind. During the attack "the face and neck were prodigiously swollen, and of a violet red colour; the child made vehement efforts to respire, and threw its head backwards for the purpose. The pulse was scarcely perceptible." "The voice was sonorous, and presented the character of croup; it was acute in inspiration, and like the cries of

⁹ Aussitôt il fit de grands efforts pour respirer." "Il se débattait d'une manière convulsive." Le Gallois, pp. 186, 187. "Cet enfant faisoit de grands efforts pour respirer, tout son corps était agité; les muscles des lèvres et de la face se contractaient convulsivement, et rendaient sa figure hideuse." Desrouelles, p. 30.

¹ Ib. p. 37.

young dogs in their sleep." In this instance, again, there was no cough, and the same absence of this characteristic symptom of true croup was remarkable in a great proportion of his cases, of which I shall only notice the third, in which the attack is thus described:—"The face was of a violet colour, extended, and swollen; the larynx ascended in inspiration and descended in expiration with great rapidity; the respiration was difficult, the anxiety extreme, the pulse imperceptible." "The voice, sonorous and stridulous, presented the croupal character in its most exalted degree. The convulsive movements of the muscles of the face and of the thorax, completed the frightful picture of this attack." I have taken these cases in succession, being the three first of his series, that unfairness in selection might not be imputed to me; and my readers will, probably, be curious to inquire how this learned and elaborate, though somewhat diffuse, writer reconciles the association of these instances with croup, of which most writers consider cough, having certain definite characters, a pathognomonic sign. This he has effected, with great adroitness, by excluding cough from his enumeration of the essential symptoms, which, according to him, are only two; 1st, the difficulty of breathing, the suffocation; and 2ndly, the sonorous inspiration, the sound denominated "croupal;" and, although he has presented us with many "physiological and practical reflections" upon these and the other symptoms of croup, including "change of colour in the face, swelling of the exterior of the neck, the throwing the head backwards, anxiety, partial convulsions or spasms, perspirations of the upper part of the body, imperceptible state (*nullité*) of the pulse, the absence of fever, excepting where there is cerebral, pulmonic, gastric, or intestinal irritation, variations of the pulse, somnolency, spasms or convulsions, the effects upon the salivary, biliary, and urinary secretions, and upon the organs of digestion manifest in the occurrence of vomitings, diarrhœa, and the appearance of the tongue, together with the spasm of the larynx upon which he asserts the peculiar sound to depend, he seems to think cough of so little moment or so rare, as not to require the

most cursory notice. It is not even enumerated amongst the symptoms, although Royer-Collard, no mean authority upon such a point, designates it, after hoarseness, as “the second essential symptom of croup.”¹

Similar observations apply to one of *our* original writers upon croup.² He begins his history of the disease by quoting and not unduly eulogizing Dr. Cullen’s definition, which includes, as is well known, the “*inspiratio strepens*,” and the “*tussis clangosa*,” but in the course of the investigation of the symptoms he only once mentions cough, and then merely incidentally. Of the thirteen illustrative examples, which he has recorded, in four only is cough noticed,³ and in these instances it had not the ordinary character; in the second it was “a short tickling cough:” in the fourth “she coughed often but brought up no phlegm, though her mouth and throat seemed full of saliva or mucus; in the fifth “he coughed up a good deal of phlegm;” and in the seventh “the child began to cough up phlegm;” one instance⁴ was so clearly a case of laryngismus, that, as it will not occupy much space, I cannot refrain from transcribing it. It is an admirable illustration of the extent to which this writer deceived himself.

“I visited,” he says, “a child, a year old, who was attacked with symptoms of the croup, in which there were evident intermissions; neither was there so high a degree of fever present, as in the cases before mentioned. She was sometimes, to all appearance, free from complaint for six or seven hours, when the symptoms again recurred as violent as ever and continued an indefinite time. Now and then they seemed to be relieved by opium, joined with volatile *foetid spirit*; at other times blisters did service. She never discharged any phlegm, and was seldom hotter than usual, even during the paroxysm. She continued better and worse for the space of ten days, gradually growing thinner and weaker, when a strong convulsive fit suddenly seized her, attended with the

¹ Dict. des Sciences Médicales, in verbo Croup.

² Disney, Alexander.

³ The 2nd, 4th, 5th, and 7th.

⁴ Case 10th.

utmost difficulty of breathing, and, in a few minutes, deprived her of a miserable existence."

The only other writer, to whom I shall allude as having confounded these maladies, is M. Vieusseux, whose field of observation was Geneva, a manufacturing town, where also Jurine, a successful competitor for the prize offered by Napoleon for the best essay on croup, was able to recognise the distinction between the two; and where, though in a healthy district, from the congregation of people for the purpose of their peculiar manufactures, the laryngismus stridulus, with other evils the no unfrequent consequences of a scrofulous taint, might be expected to prevail. In the essay of M. Vieusseux, to which honourable mention was accorded in the "Rapport" of M. Royer-Collard, he has mentioned many instances, of which, some being cases of severe distress in breathing with violent paroxysmal cough and the croup-like respiration, were unquestionably instances of the intermitting croup of Jurine, the pseudo croup of Guersent, the spurious or spasmodic croup of Ferriar and English writers in general; whilst others, consisting in attacks of breathlessness without cough, were examples of the "asthme aigu" of Jurine, Double, and other French writers, the first stage of the acute asthma of Millar, the spasmodic or convulsive asthma of Simpson, Rush, and others;—in short, of the LARYNGISMUS STRIDULUS. Of the latter kind is the 18th case, which he describes as a state of suffocation, "like that of a violent attack of asthma;" the 19th is an instance of laryngismus, sometimes with, sometimes without cough;" the 20th is similar, "*the case appearing purely spasmodic*;" the intermitting character of the 24th, the sound of mucus, the nervous condition threatening hydrocephalus, and the ultimate cure by antispasmodics, after leeching had failed to control "l'angoisse et l'essoufflement par intervalles," prove it to have been a case of laryngismus; whilst his examples "of prolonged" and "of chronic croup," of "croup followed by nervous symptoms after it was to appearance cured," were also clearly cases of one or other of the modifications of laryngismus, probably rendered, as I have often seen them, more hazardous

by depletion. At all events, a large proportion of the examples, related by Vieusseux, are without cough, and to justify his classing them with croup he is obliged, 1st, stoutly to deny that cough is essential to the latter disease;⁵ 2ndly, to allege that a child may die of an inflammatory disease before there is time for it to run its course, or to produce its ordinary effects; 3rdly, to admit that, though croup is essentially an inflammatory disease, spasm may predominate to such an extent as to account for the case appearing "purement spasmodique;" 4thly, to concede that in such instances the child may be killed by the spasm, when there may be no inflammatory appearances or products of inflammation in the air passages after death; 5thly, to hazard the assertion that croup, although in essence an inflammatory, and, therefore, continuous and unceasing complaint, may yet assume an intermitting character; and 6thly, to adopt the conclusion that the asthma of Millar is only a spasmodic variety of croup,⁶ that is, a spasmodic variety of an inflammatory disease. But these statements, inconsistent with sound medical observation and reasoning, are so at variance with, as almost to shock, our common sense; and they prove to what an extent the opinions of an acute and ingenious writer may be warped by preconception. He labours to reconcile his facts to his theory, instead of deducing his general inference that croup is an inflammatory complaint (which he assumes at the outset) from facts well ascertained and scrupulously examined. But "facts are stubborn things;" Vieusseux was too honest to attempt to distort them; but he saw not the degree in which they invalidated his conclusions.

Other authors there may be, who coincide with these views of M. Vieusseux; but they are principally amongst those, whose opportunities of tracing the distinction between these two maladies have been very limited, and whose opi-

⁵ "La toux n'est point un signe caractéristique de la maladie," *Mémoire sur le croup*, p. 15.

⁶ Une variété spasmodique de croup. *Ibid*, p. 27.

nions therefore, as little worth, need not detain me from the more immediate objects of the following essay on the LARYNGISMUS STRIDULUS, or CROWING INSPIRATION OF INFANTS.

ON THE
LARYNGISMUS STRIDULUS;
OR
CHILD-CROWING.

CHAPTER I.

HISTORY OF THE DISEASE.

THERE are few amongst the diseases of infant children more calculated to arouse the attention and to alarm the fears both of the friends and the professional attendant, than that well-known sonorous inspiration, the frequency of which has led to the familiar appellation, by which such cases are readily recognised and briefly described, of crowing children. This distressing malady, always formidable in appearance and occasionally justifying alarm because fatal in reality, consists essentially of a constriction of the glottis, which, even in its milder form, impedes the passage of air into the chest, and, in more severe instances, so completely closes it as to suspend altogether for a time the respiratory function. The child has an interruption, more or less perfect, of its breathing; and after vehement struggles, often called, and even sometimes actually, convulsive, it at length succeeds in drawing in its breath with a shrill sound, some say, like the crowing of a cock; at all events, closely resembling the peculiar inspiration of croup and

hooping cough, and arising from the same cause, a temporary diminution of the area of the rima glottidis.

These attacks are paroxysmal, and vary in their frequency, severity, and duration. At first, in general, the intervals are considerable; hours, days, or even weeks may elapse before the attacks recur: but, in the progress of the complaint, they return with such alarming frequency, that the child is scarcely free from one attack before another begins. The difference also in severity is striking. In its earlier stages the attack is often very slight, yielding at the end of a few seconds without the application of any remedial measures, and terminating in a fit of screaming or crying, succeeded by tranquil and refreshing sleep. In this state, the professional attendant, who has been suddenly summoned to the case, commonly finds his patient; but upon other occasions, and as the disease advances, so alarming is its degree of violence and so unyielding its character, that I have known a nurse, who doated upon the child which had long been the object of her solicitude and care, hurry the parents from the room, that they might not witness the extent of shaking, rubbing, and slapping, apparently bordering upon cruelty, to which she has instinctively had recourse, to restore the child from its state of impending suffocation. But the attacks also vary in the duration of the paroxysm. Early in the disease, so brief is its continuance, that, before the medical attendant can reach the house, and even sometimes before the friends can be summoned from another room, it has subsided; but in its course, the attack becomes so lengthened and "redoubled," as to continue from a quarter to half an hour, and, upon one occasion within my own knowledge, whilst a messenger traversed a distance of above a mile in quest of the medical attendant of the family.

These variations do not depend altogether upon the length of time to which the child has been subject to the attacks, which may decline or cease for a time, and then return with even aggravated violence; thus verifying the observation of the present justly celebrated Professor of midwifery in Edinburgh, that "this complaint sometimes con-

tinues for months, occasionally decreasing in violence, and suddenly again becoming aggravated; so that for a week or two the infant shall have forty or fifty attacks within the twenty-four hours, and then the number shall be diminished to eight or ten.”¹ It may not always be easy to account for these irregularities, but I have found in general, that where the severity of the disease does not progressively increase with its continuance, but has occasional remissions and exacerbations, the latter may commonly be traced to “painful dentition,” the symptoms recurring as each successive tooth advances, and gradually declining or disappearing after it has penetrated the gum.

In the earlier periods of this complaint the attacks commonly take place in the night, or after a tranquil sleep. This is a marked feature of the disease, and has been noticed by all the principal writers upon the subject.² In the language of Capuron, “l’attaque est presque toujours inopinée, subite, et nocturne.”³ But when the disease is more firmly established, and has been of considerable duration, or even occasionally from the very commencement, “they usually occur many times in the course of the day,” are brought on by causes to appearance very trivial, and “sometimes they come on from no apparent cause.”⁴

Writers have treated of this disease under a great variety of appellations, and, if any thing were required to satisfy the most incredulous that the principles of medical technology are excessively defective, or very imperfectly understood, the numerous denominations of this disease would afford ample proof of the fact. “We are overloaded with terms to express the same idea, and of these terms a great number are so loose and indefinite as to convey no precise idea whatsoever; whilst others, on the contrary, cannot fail to excite an erroneous one.”⁵

¹ Hamilton, on the Management of Infants, p. 301.

² Millar, Rush, Underwood, Capuron, Clarke, Gervino.

³ *Maladies des Enfants*, p. 439.

⁴ Clarke’s Commentaries on the Diseases of Children, p. 88.

⁵ Mason Good’s Nosology.

Amongst the writers of an early period of medical history, indeed until towards the end of the last century, it was generally described as “asthma,”² to which one added the term “spasmodic,”³ a second “acute,”⁴ a third “convulsive.”⁵ Others have described a similar disease under the appellation of “Catarrhus suffocativus cum metu epilepsiæ junctus,”⁶ or “Catarrhus suffocans,”⁷ or “Catarrhe suffocant,”⁸ or “Catarrhe suffocant nerveux;”⁹ others have called it “croup,” either “spurious”¹ or “chronic,”² or spasmodic,³ or cerebral;⁴ others a severe form of “inward fits from spasm of a vital organ;”⁵ others “a spasm about the windpipe;”⁶ others “a kind of convulsive stricture of the upper part of the windpipe;”⁷ others “a spasmodic constriction” (or “affection”) “of the chest and larynx;”⁸ others “a particular species of convulsion;”⁹ others “simply a spasm of the glottis.”¹

Without entering into any very minute consideration of these various denominations, I may be allowed, perhaps, to make a few general observations, which may suffice to prove that all are obnoxious to almost insuperable objections.

Asthma, in the limited sense in which modern writers employ that term, is a disease almost exclusively of adults, consisting of “difficulty of breathing, temporary, recurrent, accompanied with a wheezing sound and sense of constriction in the chest, with cough and expectoration;”² and how different is the wheezing of asthma from the croupy inspiration of this disease need scarcely be pointed out; nor are the constriction of chest, the cough, and the expectoration, which form part of the definition of asthma, either essential or even general

² Hippocrates, Galen, Primerosius, Etmuller.

³ Simpson.

⁴ Millar.

⁵ Rush.

⁶ Etmuller.

⁷ Lieutaud.

⁸ Baumes.

⁹ Mauciers.

¹ Ferriar.

² Underwood.

³ Burns.

⁴ Pretty.

⁵ Underwood.

⁶ Burns.

⁷ Hamilton.

⁸ Capuron, North.

⁹ Clarke.

¹ Marsh, Joy.

² It seldom appears very early in life, and hardly till the time of puberty, or after it.—Cullen, § 1374.

Asthma is more commonly a disease of the later than the earlier period of life; for it does not often appear in infancy or youth.—Mason Good, v. i. p. 578.

in this disease. The adjunct, therefore, whether spasmodic, acute, or convulsive, cannot justify the application of a term in other respects so objectionable.

Catarrh is a term which has been confined to those diseases which are attended by, or have for their essence, inflammation, with increase of secretion of the lining membrane of the frontal sinuses, nostrils, and fauces; but in this disease these parts are not implicated. No addition, therefore, can make so inappropriate a designation unobjectionable: it is "loose and indefinite, without conveying any precise idea, or, if any, only an erroneous one."

Croup, again, is now restricted in its application to an inflammatory affection of the lining membrane of the windpipe, and chronic croup should be employed, therefore, only to designate a chronic inflammation of the same part. But it has been demonstrated by anatomical examination, that there is no inflammation of the air passages in this malady. As to spurious or spasmodic croup, the terms are as objectionable as it would be to apply the epithet spurious or spasmodic to a phlegmon, erysipelas, cynanche, or pleuritis; and with respect to cerebral croup, there is about as much foundation for the expression as for cerebral laryngitis, gastritis, or enteritis.

"Inward fits from spasm of a vital organ," and "a peculiar species of convulsion," are at the best equivocal and indefinite expressions; and these, with all other designations of this disease which include spasm or convulsive movement as one of its essential characters, are founded upon speculative notions, which may or may not be true, but at least have never been subjected to any very rigorous examination.

Constriction of the chest and larynx is a designation that conveys no definite idea of the nature or even seat of the malady. There is no evidence that the chest is constricted, and the larynx, as a whole, cannot by possibility be the subject of constriction: the cricoid cartilage, which is a complete ring, prevents it. That the glottis or entrance to the windpipe is constricted or obstructed there is no question, and constriction of the glottis might therefore be employed to designate this disease, were it not that the term "constriction" is constantly

used in medical writings to imply an uneasy feeling, rather than a physical condition of an organ ; and to no part is it so frequently applied in the former sense as to the respiratory and circulating systems. So we constantly read of a constriction of the fauces, of the larynx, of the chest, and about the heart ; and it is not improbable that partly in one acceptation, partly in the other, both M. Capuron and Mr. North have employed the expression. Hence the appellation, as equivocal or inaccurate, should be discarded.

Obstruction generally conveys the idea of some extraneous substance constituting a mechanical obstacle, and perhaps the simple expression of a closing, partial or total, of the glottis might be preferable though far from unobjectionable. But in medical technology the dead languages are more frequently had recourse to, and we may adopt, therefore, as the least obnoxious to objection, the name "*laryngismus stridulus*," given to this disease by Dr. Mason Good. It points out at once the seat of the affection and the characteristic symptom. "*Laryngismus*" marks the organ affected, implies difficulty in the performance of its function to the exclusion of the idea of inflammation, and involves no speculative opinions as to the nature of the disease, which it leaves open for inquiry ; the adjunct "*stridulus*" at once announces the leading symptom which characterizes the disease. *Glottismus* might be perhaps more definite and precise than even *laryngismus* ; but the latter has already been appropriated to the disease by a very high authority, and it is sufficiently accurate and exact for all useful purposes.

Dr. Gooch, who seems to have been acquainted with this disease, has given to it an appellation by which it will be easily recognised. He calls it "*child-crowing*,"³ a designation which so admirably points at its prominent symptom and character, that I have no hesitation in adopting it as a title at once brief and perspicuous, and as synonymous or convertible with the "*laryngismus stridulus*" of Mason Good.

The shrill sonorous inspiration so characteristic of this complaint, marks very unequivocally its seat. No one who

³ Gooch's Lectures, by Skinner, 1831, p. 337.

has once heard it, and is conversant with the anatomy, functions, and pathology of these parts, can hesitate to admit, that from some cause there is an unusual approximation of the sides of the glottis, and that the area of the chink, therefore, through which in inspiration the air passes to the trachea and lungs, is sensibly diminished; the influence being very analogous to that produced by the too strong compression of the reed against the mouth-piece of the clarionet by the lips of one who has made no great proficiency in that instrument, when a harsh squeaking sound is produced abundantly discordant and grating to the ear. The crowing inspiration in this disease is, in short, identical with that which occurs in the paroxysms of croup and of whooping cough; and all agree that in these cases there is a close approximation of the sides of the rima glottidis; or, what is still more conclusive, it is the same with that which has been occasionally observed when any extraneous substance, especially, if from its irregular form, or from its acrid character, it have stimulant properties, has found its way through inadvertence or disease into that chink. The inordinate action of the arytaenoid muscles under such circumstances, excited as they are by the unnatural stimulus, cause an approach to each other of the moveable cartilages upon which they act; the aperture for the admission of air is sometimes temporarily closed, so that the individual struggles for his breath, his face is turgid, livid, almost black; his eyes stare, and seem to start from their sockets; but, at length, after continued efforts to draw in the breath, inspiration takes place through a chink which is only partially opened, and a stridulous inspiration is the consequence, immediately succeeded by violent paroxysms of cough, in the intervals between which the same stridulous sound is renewed; upon other occasions, however, the rima glottidis is never perfectly closed, in which case the first symptom is violent cough, the redoubled and violent fits of which are interrupted by the same sonorous inspiration.

The same sound is heard where a diseased condition of the glottis causes a similar degree of approximation of its sides, as is obvious from an interesting case published many years

since by Dr. Henry Seguin Jackson, who says, "The state of respiration was as follows:—On inspiration she was sensible of a resistance to the entrance of air into the anterior part of the neck. At the same time a sound was produced, difficult to be described, but harsh, croaking, and sometimes would very much resemble that attending the croup." Upon dissection, it appeared that the "aperture of, and the passage through, the larynx were so diminished from their natural size, that it would with difficulty admit a sixpence, no more of the passage remaining than a narrow slit sufficient for that purpose. This diminution of the passage was owing to thickening of the membrane lining the larynx. The edges of the ventricles were also thicker than natural; none of the muscles moving them could be distinctly traced."³ Whatever, therefore, can close the glottis just to the requisite extent, may produce this crowing inspiration.

The difficulty of describing a sound or simple sensation of any kind, has led to the use of many illustrations, by familiarity with which we might recognise this very peculiar inspiration. It is the same as in croup, and this has been described by some as like "the crowing of a cock," or "of a young cock;"⁴ by others, as like "the cry of a young cock which has the pip;"⁵ by another, as like "the croaking of certain birds heard at a distance;"⁶ by another, as like "the yelping of a fox;"⁷ by others as like "the barking of a dog, or the braying of an ass;"⁸ by others, as "a ringing sound, as if the noise came from a brazen tube;"⁹ by others, as like "the inspiration of whooping cough, or as if it passed through a contracted canal."¹

These are, indeed, illustrations rather than descriptions; but they convey a forcible idea of the character of that sonorous inspiration, which constitutes so striking a feature of the laryngismus stridulus, that it has had a tendency to withdraw

³ Ed. Med. Comment., vol. vi. p. 208. This contraction must have been extreme, seeing that the sixpence of the depreciated currency of those days was not thicker than paper.

⁴ Hôme, Wahlbom, Rosen, Salomon, Pinel.

⁵ Zobel, Michaëlis.

⁶ Thomson. ⁷ Mercier. ⁸ Rush, Cheyne, Lobstein, Double, Gastellier.

⁹ Cullen, Schwilgné.

¹ Vieusseux.

the attention of the practitioner from the state which very frequently precedes it, although it has been rarely noticed. Hence the enumeration of symptoms in this disease has been defective, and one cause of the occasional fatal termination unnoticed. Reasoning might have led to the inference, that, if the cause, be it what it may, which thus partially obstructs the entrance to the windpipe, were a little more violent, the chink might be completely closed, and asphyxia, to use the term in its more modern although inaccurate acceptance, might be the result. This greater influence of the same cause, when exerted in different degrees, has been well illustrated by Sir Charles Bell. "A blow upon the stomach," says this distinguished author, "doubles up the bruiser, and occasions that gasping and crowing which sufficiently mark the course of the injury; a little more severe, and the blow is equally fatal; a man broke upon the wheel, suffers dreadful blows, and his bones are broken, but life endures: the coup de grace is a blow upon the stomach."² Most writers upon this disease have indeed noticed the great difficulty of breathing that commonly attends it; but they have rarely mentioned its complete, though temporary interruption; and, where sudden death has arisen from this cause, they have more frequently referred the fatal termination to an attack of 'fits,' or 'convulsions,' than to asphyxia from suspended respiration. It has not, indeed, altogether escaped the discriminating observation of Mr. North; but he speaks in a tone of hesitation and uncertainty, so different from the usual decision and perspicuity of his writings, as to lead one to suspect that he had not been able to make up his mind upon the point. "So great," he says, "is the difficulty of breathing, that it sometimes *appears to be* ALMOST TOTALLY *suspended* for a few seconds."³

In the valuable practical paper upon "the spasm of the glottis," by Dr. Marsh, of Dublin,⁴ a much nearer approximation to the truth is observed. The preceding distress in breathing of an agonizing kind is strongly marked, and in

² On the Nervous System, 4to. ed. p. 162.

³ Practical Observations on the Convulsions of Infants, p. 257.

⁴ Dublin Hospital Reports, vol. v. p. 601.

many of the cases, which illustrate his account of this malady, the sonorous inspiration is represented as terminating the attack, and as constituting the recovery of the patient. In the first case recorded by him, the child "had been observed, now and again, to awake suddenly from sleep in a state of alarm and agitation, to struggle for breath, and, after repeated efforts, to recover from the paroxysm with a long and sonorous inspiration."⁵ In his third case, "the struggle in breathing was difficult and protracted, and the face, during the paroxysm, became quite livid: these attacks *usually terminated with a loud sonorous inspiration.*"⁶ In the fourth case, "a weak and delicate child, two years of age, had been subject for some time past to occasional and sudden attacks of dyspnœa, during which the inspirations were observed to be short and frequent; the head was drawn back; the sense of suffocation appeared urgent; these attacks, which were protracted and severe, *ended in a loud whoop or crow.*"⁷ In a communication also to Dr. Marsh from Mr. Newton, it is stated that the child "was observed to have occasional fits of difficulty of breathing on awaking from sleep, during which his face became livid; these lasted for some time, and *were terminated by a long, deep-drawn inspiration, with a crowing noise.*"⁸

My experience amply confirms these observations of Dr. Marsh in principle, and, perhaps, also in extent. It is obvious, that, whilst this intelligent writer considers the sonorous inspiration as the result of obstructed glottis, he must have considered the previous distress as a greater degree of the same closing of that chink. But he nowhere asserts that the edges are in contact, that no air goes into the lungs for a time, or that the child is in a state of complete asphyxia, although the communication of Dr. Johnson, who stated to him that he had seen a child in a state of *asphyxia* from this cause, recovered from apparent death by the instantaneous application of artificial respiration, might, and perhaps did, lead him to that conclusion.

The essential symptoms, then, of the laryngismus stridulus, are, sudden attacks of breathlessness from partial or total

⁵ Dublin Hospital Reports, vol. v. p. 603.

⁶ *Ib.* p. 606.

⁷ *Ib.* 606.

⁸ *Ib.* p. 614.

obstruction to the admission of air into the windpipe, varying according to the degree of closing of the glottis, and commonly succeeded, or at all events attended, by a sonorous inspiration. Where the closure of this chink is not perfect, the child struggles for its breath, the respiration is hurried, the countenance generally bluish or livid, the eyes staring, and each inspiration is attended with a crowing noise; where it is more complete, and this state at the commencement of the paroxysm, according to my observation, is much more frequent, the function of respiration is entirely suspended for a while, there is an effectual obstacle to the admission of air, the child makes vehement struggles, by some termed convulsive, to recover its breath; at varied intervals, from a few seconds up to a minute, or, upon some occasions, nearly two minutes, air is at length admitted through the glottis, now partially open, and this rush of air passing through a very narrow chink produces the peculiar sound. To these symptoms not unfrequently succeed a fit of coughing or crying, which terminates the scene; or, if the glottis be not even thus partially open, the child at the end of from two to three minutes, at the utmost, will die of asphyxia; pallid and exhausted, it falls lifeless upon the nurse's arm, and it is then that the child is generally said to have died in a fit.

In the violent struggles for the recovery of the breath to which I have alluded, all the muscles supplied by the respiratory system of nerves, are thrown into violent action; the eyes are often involuntarily rolled upwards by the agency of the trochlearis; the muscles of the face are expressive of agony, or occasionally convulsed; the head is thrown back by the muscles supplied by the spinal accessory nerve; the serratus magnus is in violent action; the diaphragm and abdominal muscles contract vehemently, and even the extremities are rigid. With all this, however, the face is commonly pallid, and has that lurid tinge, denominated cadaverous; and the external veins, turgid with highly carbonized blood, form black streaks upon the forehead and temples, which continue long after the cessation of the paroxysm.

Where the attack terminates fatally, as in asphyxia from hanging or drowning, it is not uncommon immé-

diately before death to meet with true convulsions ; but these are generally slight and tremulous, rather than epileptic. Similar convulsive movements have been observed where asphyxia has been produced in animals, by dividing the pneumogastric nerves in the neck, and the explanation of M. Brachet is an approximation to the truth. "As to the movements," he says, "more or less violent and convulsive, of the body, they are the effect of the introduction of black blood into the heart, which, by paralyzing it, suspends its action, deprives the organs of the blood necessary for the support of their natural excitement, ('excitation,') and causes by that privation a very distressing sensation, whence results the convulsive contraction of syncope so strongly developed in these last moments."⁹ The more commonly received opinion at present, I believe to be, that this injurious influence of black blood is exerted more upon the brain than the heart.

Other symptoms have been enumerated by authors, which, however, are very far from constant, but which some consider important, if not essential. One of these is a peculiar contraction of the flexors of the thumb, fingers, wrists, ankles, and toes, of a continuous character, lasting for a long time, and almost universally believed to be convulsive. So confident was Mr. North upon this point, that he has added to the designation given by Capuron to this disease, "accompanied by general or partial convulsions." That this symptom is not uncommon, the combined authority of Clarke, North, and Marsh, goes far to prove ; but, if I may rely upon the results of my own experience, I should have no hesitation in affirming, that the frequency of the symptom has been much overrated. Dr. Clarke, who first pointed out this association, goes no further than to allege, that "it is sometimes found, not only during the paroxysm but at other times ;" Mr. North asserts, that "it is usually a morbid sign ;" and Dr. Marsh mentions a spastic rigidity in the fingers and toes in several of his cases. I have however seen this disease go on from its commencement to its fatal termination without this sign, which I believe purely accidental and not to be found even in a simple majority of cases.

⁹ Brachet, sur les fonctions du système nerveux ganglionaire, p. 149.

But if it were universal, I should still entertain great doubts of its convulsive nature. Even when these contractions do occur, a moderate exertion of force will commonly overcome them, after which the parts, thus mechanically extended, will again reassume their former position, but without that violence or rapidity of movement which characterises either a tonic or a clonic convulsion. Their protracted duration also appears to me to exclude the very idea of spasm; for that must be an extraordinary spasm or convulsion which continues without intermission for weeks, for months, and even during sleep; and yet I have seen the bending of the thumb continue so long, that the integuments of the palm of the hand had accommodated themselves to this permanent position, and would allow of no more movement than the cicatrix after a burn. I have generally seen these contractions, where they have occurred, in very young or very delicate children; and they appear to me much more nearly allied to feebleness of the extensors, than spasmodic contraction of the flexors. For "a very slight survey of the animal frame will show us, that the flexor muscles have, in every part, some preponderancy over the extensors; and that the preponderancy is perpetually counteracted by the stimulus of the instinct and of the will. We see it from the first stage of life to the last, and most distinctly in those states in which there is most feebleness, and consequently in which the controlling powers are least capable of exercising and maintaining a balance."¹ When the contraction occurs only during the paroxysm, it is perhaps but the expression of distress and agony, and is more particularly apt to occur in cases of asphyxia, or great embarrassment of the respiratory function, than in true convulsions from head affection. Hence it is, that in the engravings illustrative of the position of individuals who have died of strangulation, this condition of the thumbs and fingers has been generally represented; and it is no wonder therefore, that even when not observed, or even not existing, during the intervals, it often occurs during a paroxysm of this disease. It is scarcely necessary for me to add, that when the attacks have been frequent, and these contrac-

¹ Mason Good.

tions consequently reiterated, a species of habit may be engendered which is calculated to produce a more permanent disposition of those parts to assume a flexed position.

The late Mr. Gaitskell, a practitioner of very enlarged experience at Rotherhithe, makes allusion to this state of the flexors as a consequence of teething, and considers it to be a *paralytic affection* of the extensors, rather than a convulsive movement of the flexors. In a communication to a periodical medical journal on apoplexy and palsy, he says, "I omitted, to mention, among the remote causes of palsy, dentition. This frequently produces the most alarming symptoms, and without particular treatment, invariably proves fatal. Dental irritation, by inducing encephalic excitement, paralyzes the extensor muscles of the upper or lower extremities, and sometimes all of them. These symptoms are marked by the hands being prone, and the thumbs drawn into the palms. The legs have the great toes drawn down and the feet hollowed. Sometimes the lower extremity is singly affected, and the child becomes lame. This is often mistaken for a hip case. At other times only one arm shall suffer. Occasionally I have met with this paralysis in the orbital muscles, and the child then sleeps with the pupil uncovered."

"The period of attack is between the ages of six months and two years, before the first dentition is perfected. In every instance, when early applied to, I have recovered my patient by free incision of the gums; which if they be molares, I make crucial. The division of the gums cannot be too free; and the more they bleed the more certain and speedy is the relief. If the disease be trifled with, water accumulates in the ventricles of the brain, which is succeeded by convulsions and death."²

But whatever the nature of this system, whether we believe with Clarke,³ Kellie, North, and others, that it is convulsive; with Mason Good that it is a want of balance of power

² London Med. Rep. vol. xvii. p. 167.

³ Dr. Clarke considered this symptom, in its combination with child-crowing, as "a spasmodic affection;" when, however, it occurred as a consequence of phrenitis, he thought it rather the partial recovery from paralysis; "then the flexors, being stronger than the extensors, bend the hand downwards, and turn the sole of the foot inwards."—Comment. pp. 89 and 131.

between the flexors and extensors; or with Mr. Gaitskell, that it is a paralytic affection; at least its occurrence during dentition, in combination with squinting, and as marking a propensity to, or an approach of, convulsions, did not escape that most accurate of observers, Sydenham. Speaking, in the *Processus Integri*, of the epilepsy of children, he says, "it attacks them about the time of dentition, from the seventh to the tenth month." "Sometimes the fit comes on suddenly, distorting the mouth and eyes, causing the face to turn black, and convulsing the limbs. Sometimes the fit is known to be coming on by an involuntary contraction of the fingers into the palm of the hand, and an uncommon fixedness of the eye;"² "*quandoque præsentitur ex digitorum in pugnum contractione, et ex stabili et insolitâ oculorum orbitarum immobilitate.*"³

Another symptom which has escaped the notice of the greater number of writers upon this disease, but has not been overlooked by Mr. North, is the sound of mucus in the trachea. "When the child wakes from its sleep, the breathing is for some moments unusually accelerated, and is accompanied by that kind of noise which an increased secretion of mucus in the air passages would produce."⁴ This symptom is rarely entirely absent, but is particularly apt to occur either just before or for some time after a paroxysm. In other cases, however, I have known this symptom amongst the most prominent phenomena of the disease; lasting for weeks, sometimes with little interruption even for months, and attended from time to time by cough, so like whooping cough, as to deceive the most experienced. It is this symptom, indeed, which has led to the disease being confounded with the more severe forms of catarrh with increased secretion; and were it not for the freedom of the lining membrane of the fauces, nares, and frontal sinuses from inflammation, would almost justify the terms "catarrhe suffocant," and "catarrhus suffocativus," by which this complaint has been known to some.

² Swan's Sydenham, 3rd ed. 1753, p. 656.

³ Thomæ Sydenham Opera Omnia. Genev. 1723, p. 676.

⁴ North on the convulsions of infants, p. 255.

All writers nearly are agreed in considering, that in some way or other, not however very distinctly defined, there is a natural association of this disease with convulsions ; and hence, when they see the former, they predicate the probable occurrence of the latter. It is, indeed, with them the "*catarrhus suffocativus cum metu epilepsiæ*" of Etmuller. They look upon the affection itself as spasmodic, and fear the occurrence of convulsions. The disease however, may exist simple and uncombined, as described by Dr. Marsh, and as in some of the cases which I shall hereafter detail, without any essential alliance with convulsions, either as a cause concomitant or consequence. But when the attacks of breathlessness have been very frequent and violent, occurring, as I have known them in advanced stages of the disease, every half or quarter of an hour for above twenty-four hours, attended with a lurid tinge of countenance, blue lips and tongue, and with black veins obvious and meandering under the skin of the head, forehead, and temples, with starting of the fontanelle, if that have not been already permanently closed, such is then the altered balance of circulation about the head, that the patient is unquestionably in great hazard of convulsions, and the danger is the greater, because, the congestion being of venous rather than of arterial blood, depletion is not well borne. Such convulsions are commonly fatal, from the child being unable to bear either the disease or its remedies. To this also probably may in part have contributed that impoverished state of constitution, arising from coincident disease of the mesenteric glands ; at least it was so in two cases which I have recently had an opportunity of examining after death.

It was, however, clearly the occasional association of this disease with the carpo-pedal contractions, and with general convulsions, that led the late Dr. John Clarke to consider that it was intimately and essentially connected, probably as its cause, with cerebral congestion and consequent pressure. But this opinion requires confirmation. I began indeed my professional life with a strong impression in favour of a doctrine supported by such high authority ; but more extensive and accurate observation led me first to doubt, and ultimately to disbelieve,

that such connexion is invariable or even general. I have been able to trace little in the history and phenomena of the disease, in the influence of remedies, or in the appearances upon dissection, to countenance, much less to establish, such relation. In the majority of instances, at all events at the commencement, there is no other symptom of vascular fulness and pressure within the cranium, than the sonorous inspiration, to explain which the existence of cerebral congestion is gratuitously assumed. Besides, it has been already seen, that the "crowing" is often rather nature's remedy, or the termination of an attack, than the disease itself. The very moderate measures also to which the malady often yields, would appear to exclude the idea of its dependence upon so formidable a pathological condition, for the paroxysm often gives way to a "little shaking of the body,"⁵ or "the application of some warm linen to the breast,"⁶ and is, not unfrequently, perfectly and permanently cured by change of air, lancing the gums, gentle aperients, soda, burnt sponge, foetids, anti-spasmodics, and tonics, especially quinine; and these are remedies, which whilst they have received the commendation of some of the most gifted of my cotemporaries, are such as no one in his senses would content himself with applying to a case, in which there was any thing approaching to evidence of the existence of vascular turgescence, excitement, or pressure within the cranial cavity, and in which, therefore, there was a threatening of general convulsions. Lastly, when the child has been carried off suddenly in this disease without previous convulsions, no morbid change within the cranium, the larynx, or chest, has been discovered. The child has evidently died of suffocation, from the too perfect and too long continued constriction of the glottis; "*l'enfant a été réellement suffoqué.*"⁷ Now, if it be thought that the evidence thus derived from the symptoms, the effects of remedial agents, and the appearances, or rather absence of appearances, upon dissection are insufficient to establish the negative conclusion to which I have been led, at least a cure by inducing artificial respiration should

⁵ Underwood.⁶ Gervino.⁷ Capuron, *Maladies des Enfants*, p. 439.

satisfy the most incredulous ; and this point has been placed beyond the reach of controversy by Dr. Johnson of Dublin, who “ had seen a child, in a state of asphyxia caused by this disease, recovered from apparent death by the instantaneous application of artificial respiration.”⁸ I need scarcely add, that this remedy, had the disease been situated within the cranium, could scarcely have been even temporarily, much less, permanently successful, without at least the simultaneous application of remedies for this supposed head-affection.

That these two maladies occasionally co-exist, I have no hesitation in admitting, and my experience enables me to affirm ; and, when noticing the causes of this very peculiar affection of the glottis, I shall enter into a detailed consideration of the nature of their relation to each other. At present I may content myself with stating, that, where the two are associated, although the general convulsions, and even the death of the infant, may be upon some occasions the direct result of the disturbance of the cerebral circulation, there is yet strong reason to believe, that the laryngeal affection is a distinct malady, produced by the intermediate agency of another structural disease, which may be either a cause concomitant or consequence of the diseased action within the head, and which acts in producing the laryngeal affection by its direct impression upon those nerves, which, situated in the neck or superior part of the thorax, essentially influence the respiratory function, and more especially the lining membrane of the trachea and the opening muscles of the glottis.

The cause of the crowing respiration to which I here advert, is either an enlargement of those absorbent glands of the lungs, “ which are constantly found at the root of the lungs, both before and behind the bifurcation of the trachea in the two bronchia, and frequently blend with others which lie upon the arch of the aorta, and not unfrequently between the carotids ;”⁹ or a similar enlargement of the deep-seated chain of cervical glands, known under the technical appellation of the “ *glandulæ concatenatæ*.” The former may be

⁸ Dublin Hospital Reports, vol. v. p. 619.

⁹ Cruikshank on the Absorbents, p. 129.

enlarged from exposure to cold, from frequent catarrhs, from disease of the lungs, pericardium, or heart, from a strumous taint, and probably from the extension of diseased action from the contiguous cervical glands, which, according to Haller and others, constitute a continuous chain with them; "*quæ cum aspera arteria descendunt, eæ utrumque pariter ejus ramum comitantur, et pulmonis grandia vasa circumstant et anteriores et posteriores.*" In the adult, these glands, when morbidly enlarged, may seriously embarrass the respiratory function, and even instantaneously destroy life by suffocation; in children, when similarly enlarged, they may produce the crowing inspiration, preceded or attended by temporary, and even sometimes fatal, asphyxia. To the glands thus seated within the chest, I shall first confine my attention; but numerous instances have fallen within my observation, which prove that similar symptoms may be produced by enlargement of those cervical glands, which accompany the trachea in its descent, and the morbid condition of which I shall have occasion afterwards to notice.

For the first intimation of any connexion between glandular enlargement and the crowing inspiration of infants, I am bound to acknowledge my obligation to my estimable friend, and former colleague, Dr. Merriman, who has very briefly alluded to the subject in his edition of Underwood's "*Treatise on the Diseases of Children.*" Having established the identity of "the severe form of inward fits from spasm of a vital organ," alluded to in that work, with the "peculiar species of convulsion in infant children," described by Dr. Clarke, it is added in a foot note, "In two cases of the kind, which were under my care, nearly at the same time, the children died in the fits. They were both opened by Mr. Sweatman, a very skilful anatomist, but not the slightest appearance of cerebral affection could be discerned in either of them. The principal deranged structure discovered was, a collection of small glandular swellings in the neck, pressing upon the par vagum."⁴ But this description of the diseased structure does not convey an adequate impression of its seat, its extent, or its

¹ Underwood, p. 139.

influence. The glands principally affected, were the bronchial absorbent glands, so accurately described by Cruikshank, as "constantly found at the root of the lungs, both before and behind the bifurcation of the trachea, and blending with others, which lie upon the arch of the aorta and between the origin of the carotids." In the preparations now in my possession, these glands may be seen forming a large mass, which surrounds the bronchi, and through which the orifices of the latter, undiminished in size and unaltered in shape, may be seen to penetrate; and although the par vagum may not altogether have escaped, yet it is obvious that the recurrent nerves principally have been subject to the injurious influence. In one preparation, indeed, the par vagum on the left side, as it turns around the aorta, to give off the recurrent nerve, is interposed, compressed, and much flattened between that vessel and a large mass of enlarged absorbent glands situated below and behind the arch. In this mass the recurrent seems to have been completely imbedded; and as it emerges to pursue its course along the line of union of the trachea with the œsophagus, it appears condensed, and, in the rest of its course, much withered. Higher up also in the neck, the recurrent of this side is in contact with smaller glands, which are so situated, as when compressed by external agency, to have probably interfered with its function.

On the right side also, in the same preparation, is a large mass of enlarged and indurated glands, which has sensibly altered the course of the par vagum, must have materially influenced the œsophageal and pulmonic plexus, and occupying the part where the recurrent of that side is reflected, seems to have destroyed the texture of that nerve. It has all but disappeared; the remnant, if any, appears more like condensed cellular substance than a nervous cord, and is confounded with the surrounding glandular substance.

In the other preparation upon the right side, a crop of enlarged absorbent glands is situated within the angle of reflection of the recurrent, which they have so compressed and flattened at that part, as to present the appearance rather of a thin riband than a rounded cord, and in the rest of its course is

sensibly less than the recurrent of the opposite side. Upon the left side also enlarged glands are seated close to the angle of reflection of the recurrent, and at this point the par vagum has lost its rounded character ; it has become flattened, and so thin as partially to transmit light, which neither the prolongation of that nerve, nor its smaller branch the recurrent, does in its natural state.

This description of the appearances in the cases adverted to by Dr. Merriman, I have committed to paper, having the preparations before me ; but that my readers may equally comprehend the effects produced by these glands upon the very important nerves to which I have adverted, I have thought it best to avail myself of the services of one of our most accurate delineators of morbid appearances.¹

I have reason to believe that this connexion is infinitely more frequent than has been generally imagined or could well have been supposed, seeing that it has almost entirely escaped the notice of the practical pathologist. The causes which may have prevented its being observed I need not at present mention, as a better opportunity for considering this subject will present itself hereafter. At present I may content myself with affirming, as a matter of fact, that since my attention has been strongly drawn to the point, I have had repeated opportunities of tracing the connexion, and have seen several fatal instances in which, from the symptoms in the living, I have anticipated such a morbid change of structure, and in which, after death, I have detected its existence. I shall select two of these ; one, in which no other morbid change in any other part of the body could be discovered ; the other, connected with very extensive disease of the lungs, but modifying the symptoms of the latter, so as in a considerable degree to disguise its nature.

CASE.—The first of these was an infant, in whose welfare I took the greater interest that the mother, of extremely delicate constitution, had been attended by me in her confinement of this her first and then her only child, and was my personal friend as well as patient. The child was fat but extremely pallid, and had no external glandular disease.

¹ See plates, at the end of the volume.

About the time when the incisor teeth were first manifesting a disposition to advance, without other symptoms of catarrh or suspicion of such exposure as was likely to produce it, this child became subject to a "wheezing," as the mother termed it, from mucus in the bronchi and trachea. This could be readily heard from one end of a large room to another, and the tone of this mucous rattle was much deeper than could be expected from the size of the trachea in a child of that age. For a long time this was unaccompanied by any other disturbance of the respiratory function, than occasional hurried breathing, when excited or agitated or when the trachea appeared more than usually loaded with phlegm; and there was not an approach even to fever. In this way the child would "wheeze" during nearly the whole day, with little cough or dyspnœa; and, being naturally cheerful, would continue as lively and playful as if nothing ailed it. The almost constant frown adverted to by Mr. North,² was indeed perceptible, but it was no indication of distress or annoyance; it was a miniature resemblance of the father's brow.

After this had lasted for some days, the sound of mucus would occasionally lose its continuous character, returning at intervals, sometimes of hours, at other times of days; but this subsidence of the symptoms had no such decided connexion with changes of weather, alteration of diet, or the effect of medicinal agents, as to justify my referring it to either of these causes. If any one thing excited a more beneficial influence than another, it was freely lancing the gums, but the effect of this was very inconsiderable.

As this "wheezing" was supposed to be connected merely with teething, some time elapsed before I was consulted upon an occasion, when, it being excessive, but still with little or no distress, the fears of the relatives were excited. Then, assuming the possibility of some inflammatory affection of the bronchi, although there was no other evidence of it than the sound of mucus in the air passages, I thought it right not to omit leeches, stimulant applications including a blister, mercurial and other purgatives, and such expectorants (especially ipecacuanha) as are taken from the tribe of emetics.

² "The child frowns almost constantly." North on Convulsions, p. 255.

But I derived so little advantage from these remedies, that I at length desisted from their employment. Even lancing the gums deeply, for the teeth were not near, afforded but little, and that little, only temporary relief. The child was then taken into the country, from which, upon the whole, more advantage was derived than from any other remedial measures.

Some weeks after this, the child having returned from the country, it had a recurrence of its "wheezing," with attacks of cough violent in character, coming in fits, generally and almost exclusively in the night or after a long sleep in the day, and occasionally followed by a disposition or effort to retch, which appeared to dislodge from the trachea a portion of phlegm, although it did not always expel it from the mouth. At length, upon one occasion, I was called in a great hurry to my patient, because it had awakened suddenly from its sleep in what was called a "fit." This fit had terminated before my arrival; but there was none of that heaviness of countenance and somnolency which commonly succeed to true convulsions from head-affections, nor could I learn upon the most minute inquiry, that there had been any violent alternate contractions of antagonist muscles, any convulsive agitations; in fact, any "clonic spasms" of the trunk or extremities. The child was described to have been breathless for a while, pale and cadaverous rather than florid or even purple, with its trunk and extremities rigid, its hands clenched, the spine bent considerably backwards, the eyes staring and frequently rolled upwards, and the countenance expressive of agony. At last, after an evident and severe struggle, the child recovered with a shrill sonorous inspiration, like that of the croup or whooping cough. A consultation was now held with a very eminent physician, who, in consequence of his suspicion of head-affection, so strongly urged bleeding with leeches and reiterated doses of calomel, that, with the want of absolute certainty upon my mind as to the essence of the disease, it would have been absurd to resist the proposal. These remedies were therefore tried, not only without advantage but with manifest injury. The crowing was, at the least, as frequent as before, the fits of breathlessness equally severe,

and the cough, with or without the hoop or crowing, and with or without the retching, similar in character as well as extent. And now, finding that the symptoms were in no measure subdued whilst the strength was obviously declining, I was induced to try such remedies as might tranquillize the cough, and at the same time uphold the constitutional powers. To fulfil these objects, I directed the combination of hop, sometimes of henbane or hemlock, with mineral acids, taking care to prevent accumulation in the bowels by moderate aperients. Embrocations also combining stimulant and sedative properties were employed, and a more generous diet recommended.

Under this treatment, begun in London and continued in the higher and more healthy division of Essex, the child appeared for awhile to be benefited. It was, however, observed that slight causes, as the supposed advance of the teeth, or a continuance for days of damp weather combined with cold would bring back or aggravate the symptoms. Some relatives, who now heard the cough, were so convinced from their familiarity with the disease in their own families that it was hooping cough, that I was entreated by letter and readily persuaded to allow the child to take the half-professional, half-popular, combination of cochineal and salt of tartar. In spite, however, of this *all-powerful* remedy, the cough, the wheezing with the crowings recurred, and the child was now rarely, if ever, free from hurry and distress in its breathing. This becoming more alarming, the child was brought to London, that it might be principally under my care. It was now so reduced in strength, notwithstanding that it continued fat, though pallid and waxy, that I once more urged a consultation; and, now, I had the pleasure of conferring with Dr. Meriman.

We were both apprehensive about the state of the lungs, and both considered the child in imminent hazard, not only on that account, but in consequence of irregular fever approaching in character to hectic, and of an unmanageable diarrhœa, which might be termed colliquative. I had however strong suspicions, which I had repeatedly stated to the

friends, that "the glands at the back of the chest were enlarged." It was further agreed, that in a case so severe, yet presenting some obscurity, little more could be done than to support the system, to quiet the cough, and to restrain the purging. The remedies suggested for this purpose I need not particularize, as they were ineffective. The patient, after occasional attacks of breathlessness, of crowing, and sometimes of violent cough, having made vehement but ineffectual struggles to recover its breath, fell at length lifeless upon its side in the nurse's arms.

The relatives, to whom some kind friends had persisted throughout in insinuating that this little patient must labour under water upon its brain, were as anxious as myself that the body should be opened. I had from the earliest period up to the last moment assured them that there was not the slightest evidence of such disease; and I was desirous that the body should be examined by some one expert in such examinations and in the use of the knife. I prevailed therefore upon my colleague, Mr. Arnott, to accompany me for that purpose. All the viscera were healthy. There was no trace of arachnitis, or vascular congestion, or water within the cranium. The abdominal cavity was free from disease, with the exception of a very slight enlargement of some of the mesenteric glands. The lungs were perfectly healthy, spongy, and crepitous. Upon inspecting the bronchial absorbent glands, to which, mentioning my expectations to Mr. Arnott, I directed his peculiar attention, my anticipations were fully realized. The cluster of glands at the root of the lungs, and about the arch of the aorta were greatly diseased; one of them, as large as a moderate sized chesnut, being full of the curdled half-puriform matter so characteristic of strumous inflammation; another smaller one having also imperfectly suppurated.

CASE.—Soon after this case had occurred to me, the child of a late banker was placed under my care. It had occasional attacks of breathlessness, threatening suffocation, from which it recovered with a crowing inspiration. He suffered also from occasional fits of cough, differing from hooping cough in no-

thing but the symptoms between the paroxysms, and the absence of vomiting or retching at its conclusion. This boy had always been delicate, and was now excessively emaciated ; but the parents dated the accession of the present disease from the occurrence, about twelve months previously, of measles and hooping cough together, or in very rapid succession. From these he never completely recovered, but was left much weakened and extenuated ; he was never afterwards quite free from cough, and this was always greatly aggravated upon the slightest exposure to a damp or cold air, and even by very moderate exertion. He had now a permanently rapid pulse, with proportionately hurried respiration, some degree of irregular fever, and a circumscribed hectic flush upon the cheek. The cough was unattended with expectoration, and had been so throughout the whole progress of his complaint. Sometimes a mucous rattle was observed before a paroxysm of cough, which, occurring more particularly at night than by day, was ascribed to the horizontal posture. Upon many occasions, however, there was no cough ; but after an attack of breathlessness of longer or shorter duration, the child would recover with several successive crowing inspirations.

Having stated to the friends my apprehension that there was disease of the lungs, (though I had then no idea of its extent,) combined probably with enlargement of the glands at the back of the chest, and that upon the whole my fears greatly predominated over my hopes, they readily consented to a consultation, and a physician was named, who had been accustomed occasionally to attend the family, who was deservedly at the head of his branch of the profession, and pre-eminent for the rapidity and general accuracy of his discrimination of disease. Whilst we were together in the room, the patient had one of his paroxysms of cough, when the physician with whom I was consulting, was at once convinced of the nature of the malady, and said immediately upon our return to an adjoining apartment, " If ever I heard hooping cough that child has it." His view of the complaint was therefore more favourable than my own, and the friends were

gratified by the announcement, that the disease under which the child laboured was a "spasmodic cough," (about which there could be no dissonance of opinion,) likely to be of considerable duration, recovery from which depended upon the child's power to struggle against a lingering disease, with, however, considerable chances in favour of ultimate recovery, and requiring light but nutritive diet. But whatever difference of opinion might exist as to the precise name and nature of the complaint, we were cordially agreed upon the more important point, the remedies to be employed, which consisted principally of mineral acids and hemlock in the infusion of roses, very moderate aperients when requisite, and the application of local irritants to the surface of the chest.

The gloomy anticipations which I had formed, were speedily realized; for within a fortnight of this period, the boy sunk under his disease. Upon examining his chest the lungs were found honeycombed throughout their whole extent with vomicæ, varying in size from a pea up to that of a horse-bean or something larger, distinct, circumscribed, and encysted; but no one of them having, as far as could be traced, any distinguishable communication with the bronchi. There was very considerable enlargement of the bronchial absorbent glands, to which I was disposed to refer (as from the symptoms I had expected to find such morbid changes) the rattle of mucus in the trachea, the occasional brief suspension of the respiratory functions, the crowing inspiration, the violent spasmodic character of the cough, and its recurrence principally in the night; such symptoms being highly characteristic of such a pathological condition of the glands within the chest, but very uncommon in phthisis.

I have seen other cases of occasional breathlessness, threatening suffocation, in which I had strong suspicion, and in some instances even complete belief, of the existence of similar structural disease; but the evidence is necessarily imperfect, as either the children have recovered, or anatomical inspection has been refused in fatal instances. They have had the crowing inspiration, sometimes preceded by a temporary but total suspension of respiration, and occasionally attended, more

frequently succeeded, by violent spasmodic cough; they had no one symptom of vascular congestion or excitement within the head; there had been no cognizable irritation from teething; the stomach and bowels have done their office moderately well; they have been either the children of parents in one or both of whom a strumous disposition might be more than suspected, or manifesting by unequivocal evidence a strumous habit in themselves; and all have been more benefited by change of air than any other remedies. One of these is sister to the child whose case I first detailed, and very like the brother in constitution and complexion. This child has been occasionally under my care in London, and one consultation has been held with an eminent physician upon her case. I have also been frequently consulted by letter from the country, on account of symptoms analogous to, even identical with, those which ushered in the disease in her brother. She has had the "wheezing," the crowing inspiration, and sometimes spasmodic cough, but fits of complete asphyxia have rarely, if at all, occurred. The disease has been kept under control by constant residence in the country; her time having been divided between the higher parts of Essex, Bedfordshire, and Hampshire, at some distance from the sea. But it is unnecessary further to multiply instances. Enough has been advanced to prove conclusively, that the "peculiar species of convulsion in infant children," described by the late Dr. Clarke, may arise without cerebral excitement or pressure; and that amongst other causes, enlargement of the absorbent glands "both before and behind the bifurcation of the trachea," "blending with others which lie upon the arch of the aorta, not unfrequently between the origins of the carotids," may, and does, much more frequently than is generally imagined, produce it.

It was at one time my impression that no enlargement of glands in any other situation would produce similar results. Where, therefore, I found the crowing inspiration without other assignable cause, more especially if combined with the sound of mucus in the trachea, the fits of breathlessness, or the spasmodic cough, (for these are just part and parcel of the same

ailment,) I was disposed to infer the existence of such disease. Subsequent observation, however, soon convinced me of an error which analogical reasoning first led me to suspect. Examining minutely the preparations in my possession, as well as the enlarged glands in the fatal cases which I have recorded, it was obvious to me that the air tubes had suffered nothing from pressure; the trachea retained its ordinary dimensions and form, and the bronchi, where they were cut through as they pierced the glandular mass, had still their regular shape and usual size. The symptoms, therefore, could not be ascribed to mechanical obstruction from compression of the air tubes. Besides, the effect was produced not upon the bronchi, where the disease was situated, but upon a mere fraction of the larynx at a distance from the diseased mass, the rima glottidis. This could only be effected by some influence transmitted through the nerves, and the mystery is completely solved when it is borne in mind that these glands are enlarged at the very part where the recurrent nerves turn round to be distributed in their ascent upon the fibrous texture at the back of the trachea, upon the lining membrane of the canal, and ultimately upon the opening muscles of the glottis to influence the movement of that all-important chink; and that, in one of the preparations to which I have alluded, the nerve had been carried much out of its natural position, was flattened, and had undergone considerable change of texture from the morbid enlargement of the bronchial glands. From these circumstances it was impossible not to infer that the phenomena were the result of some effect upon these recurrent nerves produced by the enlarged and indurated glands in their vicinity, and, if so, it was by no means irrational to expect that, if a similar impression were produced upon these nerves in their course upwards to their ultimate destination, the muscles upon which the movements of the arytaenoid cartilages depend, similar symptoms would be produced. This view of the subject opened a new and important field of investigation both speculative and practical; and its interesting nature would have amply repaid me for the devotion of much time to the inquiry, even had the prac-

tical conclusions, to which it leads, been unimportant. The more speculative parts of this subject I shall reserve for future consideration. It will be enough for the present to point out certain interesting pathological relations of the cervical absorbent glands, which have hitherto been considered only as mere abstract points of descriptive anatomy or with reference to the lymphatic system of which they constitute a part, but rarely in connexion with the very important textures and organs with which they are in close contiguity.

It is well known that there is a chain or cluster of glands lying directly in the course of that important sheath in the neck which contains the internal jugular vein, the carotid artery and the par vagum, and consequently close to the trachea.³ These glands, called the *glandulæ concatenatæ*, “ frequently enlarge and inflame from scrofula alone,” but “ they may be enlarged also, not only from particular affections of the mouth, and of the integuments on the outside of the head, but from affections of the brain and its coverings.”⁴ If, therefore, in cases of enlargement of the bronchial glands the crowing inspiration could be fairly ascribed to their effect upon the recurrent nerve, as proceeding from the par vagum it winds round the subclavian artery upon one side, and the arch of the aorta on the other, it was not improbable that enlargement of the cervical glands, contiguous as these are to the par vagum and still more to the recurrents in their course upwards to the side of the trachea, would be attended with similar results. My experience has supplied me with numerous instances of this kind; the glands were enlarged from the very causes enumerated by Cruikshank; and the crowing inspiration, with the other symptoms so characteristic of an affection of the nerves, occurring and increasing with their growth, and subsiding or terminating with their decrease or disappearance, abundantly establish the nature and frequency of a connexion, of which the following cases are illustrative.

CASE. Dec. 1833.—A. W., aged four years, residing in my neighbourhood, rickety, scrofulous, and the child of un-

³ “Utriusque lateris cum aspera arteria continuatur.”—Haller.

⁴ Cruikshank, on the Absorbing Vessels, p. 131.

healthy parents, has been subject for some time to severe cough, commonly “accompanied with that kind of noise which an increased secretion of mucus in the air passages would produce;”⁵ but without fever or any other symptoms of catarrh. The parents represent these attacks as coming on principally, if not exclusively, in the night. Sometimes the child is breathless, and apparently threatened with suffocation; at other times, or succeeding to the state just described which amounts to temporary asphyxia, it has a violent spasmodic cough resembling whooping cough; and both are attended or followed by a sonorous inspiration like that produced by a fragment of a solid body, or a drop of stimulant fluid, finding its way within the glottis, or like the crowing inspiration of pertussis or croup.

By day, this child is apparently quite well, cheerful and playful, without cough or distress of breathing. Its appetite is good, but the bowels torpid; and when the child is suspended by the armpits and chest, with the belly exposed, the abdomen is tense and tumid, or, in the vigorous language of Dr. Millar, “inflated;” and this state exists in an especial degree above and to the left of the umbilicus. At night, the child readily falls asleep when put to its bed, but at the end of from four to six hours the sound of mucus in the trachea is observed, and this the mother well knows is but the precursor of an attack either of the breathlessness or of cough. Soon after this she awakes suddenly, looking ghastly, to appearance strangling, the eyes staring, the features distorted with, because expressive of, agony, the body bent rigidly backwards, the limbs rigid and extended, and the hands clenched. This state at length is succeeded by a crowing inspiration, and attended or immediately followed by violent cough coming in fits, with crowing in the intervals like what the husband had observed in a disease, of which he saw his younger sister die, and which he was told was croup. The cough often lasts for half or three-quarters of an hour, when the child, exhausted, falls upon its pillow and sleeps soundly for from four to six hours, again to be subjected to the same

⁵ North.

series of symptoms; and such is the vehemence of this cough, that the fears of the parents have been twofold; they thought that either "a blood vessel must surely burst," or that their child "must die suffocated."

Some thought this disease must be whooping cough, which, however, several considerations led me to disbelieve. 1st. Although the mother anticipated a paroxysm when she heard the mucus rattle, yet the child had no foreknowledge of its approach, and did not therefore, as in pertussis, show previous signs of restlessness, struggle against it or seize the first person or object within its reach for support. 2ndly. The attack generally began with a complete suspension of the respiratory function, during which there was an obvious and vehement struggle for the recovery of the breath, which is at least far from common in whooping cough. 3rdly. The cough was rarely attended with disposition to retch at the conclusion of the fit. 4thly. The paroxysms never came on in the day when the child was sporting with its playmates, but always after it had slept tranquilly for from four to six hours. 5thly. It had not been in the way, as far as the friends knew, of catching the disease; and lastly, there were several children in the same house who had never had the whooping cough, who were in constant intercourse with this child, their playmate, and who yet after an interval of months have shown no symptoms of that disease. My attention was therefore directed to the glands of the neck, which, I now well know, might produce such symptoms, and I found them, from the angle of the jaw to the sternum and in the course of the clavicle, much enlarged and indurated. They could even be seen when the child's neck was turned to one side or bent backwards so as to put the integuments upon the stretch; and I directed the father, a man servant with whom I was in daily communication, to examine them, that he might be able to judge, and report to me, of any relative increase or diminution of size.

The means which I recommended were simple. They consisted of gentle aperients, and the infusion of roses as the vehicle of a mineral acid and tincture of hop; in other words, of a combination of a mild tonic, with a very moderate

narcotic, and this with generous, but unstimulant, diet. The child was also directed to be kept up stairs in a warmer apartment, which had hitherto been reserved only as a bedroom.

Within a week the cough had sensibly subsided; the child had one fit in the night instead of two, and that had been at once shorter in duration and less severe; the attacks of breathlessness had nearly ceased, the crowing was less marked, and *the glands were evidently diminished in size*. In another week the cough had become slight, and no longer caused any anxiety; and now the glands, which had been before as large as marbles, were reduced to the size of peas. A few days after this the child was sent, for the remainder of the winter, to Clifton. The mother, who accompanied her, returned at the end of a fortnight, and called, with great thankfulness, to tell me that she had left her child perfectly free from cough or any other affection of its breath, in high spirits, joining other children in their sports, and undergoing as much fatigue as others of the same age; bearing well and with temper the confinement of a day-school, and with the "lumps in the neck" scarcely to be felt, and not at all to be seen. The belly also had regained its natural size. This report much gratified me, a younger brother having recently died of, what had been termed, fits. Some had, therefore, expressed their fears, that this child was in great hazard from "water upon the brain;" but the symptoms coming on in this case with the enlargement of the glands, subsiding as these decreased in size, and ceasing with their disappearance, it is impossible not to refer them to such obvious pathological condition.

I incline to the opinion that in this case the glands were enlarged in a child prone to such disease, from exposure to cold and damp in a kitchen, below the level of the street, occupied by its parents for a mangle. To this apartment, in which the child remained great part of the day, the staircase led directly from the street-door, which, in a house occupied by many families, was in perpetual motion, fanning the inhabitants of these lower regions with the no very salubrious air of a very confined street leading from Shepherd's Market.

CASE. Dec. 4, 1833.—William Scott, aged two years, having all his deciduous teeth, was brought to me on account of cough, disturbing him principally in the night, preceded by the sound of mucus in the trachea, coming in fits, and “*almost seeming to strangle him.*” He has also, upon some occasions, complete suspension of his breathing without cough, from which he recovers with a sonorous inspiration. These symptoms, however, did not so much alarm the mother as an opinion, which had been confidently expressed, that the child must have “water upon the brain.” Excepting the sound of mucus, which is not constant, this child has no symptom of catarrh or inflammatory disease of any kind. The limbs are much extenuated, the belly enormously distended, but not symmetrical, the principal enlargement being above and to the left of the umbilicus, gradually diminishing towards the pubis. The appetite is good, often ravenous; but much of the food taken passes undigested through the alimentary canal. This is particularly the case with milk and with potatoes, the former appearing in small curdled masses mixed with greenish and slimy motions, the latter totally unaltered in character.

As there was no one circumstance, besides the crowing inspiration, which could lead in this case to a suspicion even of head-affection, my attention was at once directed to the state of the cervical absorbent glands, the whole chain of which I found enormously enlarged and indurated, and this, apparently, from a scabby eruption upon the face and scalp. The only medicine prescribed was a combination of a mild mercurial with rhubarb and carbonate of soda, in such dose daily as might gently open the bowels; and I confined myself to these simple measures, that I might see the effect of directing my treatment principally to the eruption, upon which it was my belief that the whole series of phenomena depended. This eruption I considered to be the cause of the diseased condition of the glands; the enlargement of the glands influenced the recurrent nerve, probably the par vagum also; and the affection of these nerves produced the symptoms referable both to the respiratory apparatus and the stomach. I directed, therefore, the scabs to be poulticed, where poultices could be applied;

in other places to be fomented with a sponge and warm water, until the crusts should separate ; then the surface beneath was to be very slightly smeared with the unguentum hydrargyri nitratis, diluted with three-fifths of spermaceti ointment.

13th. There has been no return for two or three days of the breathlessness or crowing, and the cough is greatly diminished. The eruption is fast disappearing ; and the glands near the trachea along the lower half of the neck are greatly diminished in size and hardness. Those nearer to and behind the angle of the jaw remain still of considerable bulk.

26th. There have been no further attacks of breathlessness, crowing, or "*strangling cough*." The stomach is greatly reduced in size, and there is no longer undigested food in the motions. The child is full of life and animation, and the eruption quite gone. All the glands anterior to the sternomastoid muscle have disappeared, but some behind the line of that muscle are still distinctly prominent.

Jan. 19.—No return of the symptoms, though there is now a little eruption upon the ears and upon the scalp immediately behind them, and although the glands towards the back of the neck are still large and prominent.

In this case, little doubt can exist that the enlarged cervical glands were the cause of the malady, and that it was the enlargement of those glands only which lie near to the trachea which produced the disease. There was no reason to suspect in this instance that the bronchial glands were simultaneously affected, seeing that the cause of the enlargement was not so much a constitutional taint, as a local irritation exciting the glands in the course of the lymphatics proceeding from the eruption towards that part of the venous system into which these vessels were to enter. The bronchial glands, beyond the reach of irritation or contamination, had probably escaped.

CASE. Dec. 2, 1833.—Caroline Rycroft, aged eight months, pale and flabby, has been brought up entirely at the breast of its mother, a young woman of twenty-two ; the father having through life been subject to enlargement of the glands of the neck. This child was well till Sunday, Nov. 11, when it was suddenly seized with what was called "a fit," which came on

with "a gasp" immediately upon the mother beginning to *wash its head with cold water*. During the attack the body was never violently agitated with convulsions, but the limbs were rigid and extended, the trunk bent backwards, the hands permanently clenched, after an attempt to grasp the first object within their reach, the countenance at first pallid, then "*of all colours, the face, in fact, like a corpse*," the veins blueish, and "*showing very much*," the lips first colourless, and afterwards livid; and altogether the child "appeared to be strangling." From this she at length recovered, with an interrupted crowing inspiration, when, after crying violently for three-quarters of an hour, she fell exhausted into a tranquil sleep, which lasted for three hours. She had cut the two lower incisor teeth, and the upper, which were evidently advancing, had been lanced. Two leeches had been applied to the head, and some opening medicines given.

Since these means were employed, she has been somewhat better; there has been no return of "fits" of such alarming severity, but the child has constantly awakened in the night, screaming so violently as to arouse the parents, who then find it "struggling for its breath;" each attempt to draw its breath being commonly attended with the crowing inspiration, and the clenched hands. But as the parents appear to sleep soundly until the crowing or the screaming awakens them, they are unable to say whether the breathing has or has not previously been completely suspended.

In the course of the day, this child is comparatively free from ailment; it has no attacks, and its respiration is unembarrassed, excepting that this function may be somewhat hurried for some time after "a fit of crying." The fontanelle is not at all elevated, and there are no symptoms of cerebral congestion or excitement. The veins, however, upon the forehead and temples are somewhat injected, and dark coloured. There are acrid excoriations with suppuration behind the ears, which are much swollen from erysipelas; and from the angle of the jaw along the whole course of the great vessels of the neck, towards the side of the trachea, and in the direction of the clavicles, the absorbent glands are much enlarged and

indurated; those above the right clavicle being larger and more numerous than upon the left side.

The mother brought this child to me, because, from the croupy inspiration, a highly respectable practitioner of midwifery had assured the grandmother, a monthly nurse of considerable experience, that it had water upon the brain. I was convinced, from what I had seen in numerous other instances, that the symptoms in this case depended upon the enlargement of the *glandulæ concatenatæ* exercising either a direct, or, through the par vagum, an indirect influence upon the recurrent nerve; and that this morbid increase of size in the glands was the result of the inflammation about and behind the ears. I contented myself, therefore, with the very simple measures of washing the parts affected frequently in the day with tepid milk and water, and giving daily four grains of rhubarb, with six of carbonate of soda.

16th.—There have been for some days no further fits of breathlessness; the child, however, coughs in the night. This cough comes in paroxysms, and is preceded by "*phlegm in the throat*," but there is neither cough nor sound of phlegm in the day. The glands are diminished in size, and softer; the erysipelas has greatly subsided; and the excoriation, or "running tetter," is much less angry.

27th.—There has been no return of the "strangling fits;" but the child still hoops, and occasionally coughs; less frequently and less severely, however, in the day than after sleep, when either or both of these symptoms will frequently occur, preceded by the sound of mucus in the air passages. During the day she is almost free from these symptoms.

Jan. 7th.—The cough is now very unfrequent and slight, even in the night; there has been no fit of breathlessness, and the crowing has entirely disappeared. The whole appearance of the child is greatly improved; "it looks," said the mother, "like another child." She coughed whilst in my room; but the cough is very trifling, like that of a slight catarrh, and loose. The discharge behind the ears has ceased, the inflammation has subsided, and the strength is so greatly increased, that the child can now stand with the support only of a chair.

The glands are not quite gone, but they have greatly decreased in size, and become soft.

The remedies were never changed.

This case is very analogous in character to the last. An inflammatory affection of the integuments of the head had caused considerable enlargement of the cervical absorbent glands, which, by their injurious influence, directly or indirectly, upon the recurrent nerve, produced the breathlessness amounting to temporary asphyxia, the crowing, the sound of mucus in the air tubes, and cough of that character which the friends constantly denominated "strangling, and which is one, amongst others, of the consequences, and therefore a characteristic symptom, of enlarged bronchial or cervical glands. As the glands became less, the more severe form of the disease, the temporary but complete suspension of the respiratory function disappeared, leaving only the crowing inspiration and occasional attacks of cough. A further diminution of their size was followed by a cessation of the crowing inspiration; and when they had nearly disappeared, even the peculiar cough ceased also; the last in the series of symptoms which remained being the sound of mucus in the trachea, and a common cough for its dislodgement. This order is what I have generally observed; and the symptoms on the approach of the disease, when traced from its commencement, as in the first case of enlarged bronchial glands which I have detailed, have a similar relation to the progressive enlargement of the glands. At first there was in that case wheezing, with occasional common cough for the dislodgement of the accumulated mucus; then violent cough, like whooping-cough, sometimes with, sometimes without, crowing; then "a fit,"—of asphyxia, however, rather than convulsions,—from which the child recovered with the interrupted sonorous inspiration which gives the peculiar character to the ailment, and from which a morbid condition of the brain is so frequently inferred.

CASE. *March 1834.*—A very intelligent physician called upon me to request that I would see and take charge of his child, who, since the commencement of the irritation from

teething, had been subject to fits of crowing inspiration. In other respects the child was in good health; he had no suspicion of head-affection, and had been unable to detect the existence of any enlargement of the cervical glands. Upon minute examination, however, in particular positions of the neck, and by pressing the fingers deep under the sterno-cleido muscle in a direction from the trachea outwards, I could occasionally perceive two pisiform enlargements, which led me very strongly to suspect the existence of tumid glands in that direction. Occasionally, the nights of this little patient were frightfully disturbed by these fits of breathlessness and sonorous inspiration; and it was always found when this was the case, that the gums were much expanded and inflamed, and at these times the glands in the neck always became very perceptibly increased in size; upon all occasions, when the symptom had been absent for some time, the glands were less and softer. These glands became so distinct after the lapse of a few weeks,¹ as to be easily recognised by the parents, and even by the nurse; and they were larger immediately over the side of the cricoid cartilage and immediately below it, than in any other direction. I believe the tumours in that situation to have been the efficient agent in producing the symptom; first, because they had a hard substance against which to rest, and by compression to influence the recurrent in its course; and, secondly, because the mucous rattle has rarely, according to the accounts of the attendants, been observed. Had the glands lower in the neck, or within the thorax, been affected, then, as far as my observations enable me to speak with confidence upon the subject, the mucous rattle would have been manifest; for this depends upon the same cause, which influences the muscles of the glottis, affecting also, directly or indirectly, the numerous but minute filaments which pass from the recurrent to supply the fibres at the back of the trachea and lining membrane of that canal. This child has since had several attacks at different and sometimes distant intervals, and upon one occasion, an attack of inflammatory croup requiring active remedies supervened. At

¹ Med. Gazette, April 5, 1834.

length, however, the four canine teeth having pierced the gums, it has been for about three months free from attack, and is greatly improved in appearance.

Excepting during this attack of inflammatory croup, the treatment has been throughout exceedingly simple, consisting almost entirely of moderate but efficient aperients, lancing the gums when their inflamed state required it, (when it was generally followed by a diminution of bulk as well as of hardness in the glands, and a corresponding alleviation of the symptoms,) and occasionally tonics. I wished to send the child into the country; but, the father being upon the continent, there were insurmountable obstacles to the accomplishment of this.

The recovery of this child was more than upon some occasions I was entitled to anticipate, and the case seems to me to afford a satisfactory illustration of the dependence of this disease upon enlarged cervical glands, the consequence of difficult and painful dentition.

CASE. — A case communicated to me by my friend and former pupil, Mr. Elwyn of Poland-street, I cannot deny myself the pleasure of inserting here as it was closely watched, minutely observed, and examined by him after death.

“ J. A. aged nine months, was always delicate, but never seriously ill until three months since, when the parents first observed ‘ something peculiar in its breathing.’ It seemed one day, when waking out of its sleep, to be nearly choked. It had another attack on the same day, and after this there was frequent spasmodic crowing, especially when the child was excited, when it awoke from sleep, or after meals.

“ When first visited the diagnosis was difficult, and a guarded statement was therefore made; but there was some suspicion that it might be whooping cough, the sounds in inspiration resembling each other. But after a few more visits it became pretty clear, that the disease was that so well described and reasoned upon by Dr. Ley. The peculiar countenance, the distortion of the limbs, and, above all, the visible enlargement of the cervical and even axillary glands warranted a decided opinion as to the real nature of the com-

plaint. The spasms or fits gradually increased, and more than once I was called in suddenly to witness the death of the child. Upon these occasions there seemed little or no hope of recovery; nevertheless, in time the purple countenance disappeared, the blanched lips resumed their hue, and respiration returned. The child however rapidly fell away, and as it became weaker, the fits returned with less violence but greater frequency, coming on every quarter of an hour."

"Their character was the same, only that latterly there was less of the excited attempts at respiration. The infant was cheerful during the intervals, and now and then rallied and gave slight hopes of improvement. Alteratives, aperients, and tonics were employed but without avail; the child died three months after the first symptom of disordered respiration."

Post mortem examination.—"The submaxillary, parotid, sublingual, and, indeed, almost all the glands throughout the body, were not only enlarged, but even apparently increased in number. The mesenteric particularly were diseased.

"The bronchial glands upon the right side surrounded the recurrent nerve, which was completely imbedded in a cluster of enlarged glands. On the left side there was to be seen but one, and that one not large. It was about the size of a pea, very hard, and seemed to press upon the nerve, squeezing it, as it were, against the trachea. The nerve in its course was accompanied by other glands."

The larynx was healthy, the lungs gorged from congestion, in some parts almost resembling pulmonary apoplexy. The heart was hypertrophied, the left ventricle being also enlarged.

CASE. Dec. 19th, 1833.—W. C., aged fifteen months, the child of a very respectable tradesman, has been brought up at the breast of the mother, with, however, occasional feeding. It had violent convulsions last March, for which, before I saw it, blood had been drawn largely from the jugular vein; it had taken large doses of calomel, had been actively purged, and had recovered, at least, from its fits. From that period, however, to the present time, it has had a depression of the globe of

each eye, which, in its ordinary movements, keeps the upper edge of the iris constantly in view. In other respects and directions, the motions of the eye are perfect.

This child is now pallid, with the fontanelle open, but depressed; the muscles flabby, the limbs extenuated, but perfect in their movements, the belly tumid, especially at its upper part, falling inwards towards the pubis, the bowels torpid, though moved by moderate aperients, when the stools are heavy and offensive, often containing undigested milk, and, according to the mother, "always nasty." The direction of the axis of the eye is still downwards, and when the child attempts to look at objects above the level of this altered axis of the pupil, it raises the head, not the eye, for the purpose. There is no strabismus, the child has no intolerance of light, it delights to follow the glare of a candle, or gaudy objects of any kind, and the pupil plays perfectly and quickly. The hearing is also perfect, without impatience of noise; and the child, distinguishing the voices of different persons, betrays its little partialities; leaving readily the mother for the father, who plays much with it; and quitting equally readily the father for the nurse, who, after all, is its greatest favourite. Its senses, therefore, both external and internal, are perfect. It has also, occasionally, those contractions of the fingers, thumbs, and toes, which have been technically called "carpopedal contractions."

This child often awakes suddenly in the night, struggling for breath, with its hands clenched, its limbs rigidly extended, the spine bent, as in opisthotonos, the head thrown backward, the eyes staring, the face pallid and death-like, the lips colourless. The nurse is in constant fear that it may strangle, and therefore "pats it upon the back, and shakes it violently to bring about its recovery." At length, after vehement struggles, the breath is partially recovered with a sonorous inspiration, and the sound of "*phlegm in the throat*" is heard. Soon after this a fit of screaming ends the attack, and the child falls asleep. These fits are comparatively rare in the day, but in the evening they return, and are frequent through the night, recurring, it is said, nearly every quarter of

an hour. The two lower incisor teeth have pierced the gums: in the upper jaw, the gums are much expanded and inflamed.

The neck is studded with enlarged and indurated glands from the angle of the jaw, throughout the whole course of the chain, extending under the sterno-cleido muscles to the sternum, and in the direction of the clavicles. In size and hardness they are like marbles or bullets.

Having lanced the gums freely, I directed for this child small doses of the hydr. c. cretâ, with minute quantities of ipecacuanha, and a mixture, the chief ingredients of which were infusion of rhubarb and cascarilla, with carbonate of soda, twice in the twenty-four hours.

Dec. 23rd.—The fits have been less severe and less frequent, and there have been none in the day. For the last two nights especially, their frequency and violence have been much diminished, and the child is altogether improved. The gums covering the upper incisors are still expanded, but less inflamed; and the glands in the neck, if not less, appear somewhat softer. The bowels being scarcely sufficiently open, I added rhubarb in substance to the powders, and omitted the infusion.

26th.—Has not been quite so well. The fits of breathlessness and crowing have been more frequent. The medicines, therefore, were changed for calomel and scammony twice a day, with saline aperients.

30th.—The child is reported to have had “a dreadful night;” its fits of breathlessness have been so severe, that the parents were the whole night in fear that it would be choked. Had another fit this morning, from which the child was so long in recovering, that the friends at one time “thought it was really strangled.” The face is pallid, but the veins are strongly marked, and the fontanelle for the first time decidedly elevated. Unable to divest myself, therefore, entirely of the dread, that there might *now* be, at the least, venous congestion within the head as a concomitant or consequence, if not a cause, I felt I should not be justified in withholding altogether remedies, in which, under such circumstances, many would

place reliance. Six leeches were therefore applied to the temples and forehead, more active aperients, including frequent doses of calomel, were directed, the tepid bath was to be used night and morning, and cold to be sedulously applied to the surface of the head.

The child slept better for a few hours after the application of the leeches, but its appearance upon the following morning was almost cadaverous; its eyes, even more downcast than before, were dull and glazed; the fontanelle was again sunken, but the fits had become nearly as frequent and alarming as before.

January 1.—There has been little improvement. The attacks of breathlessness, and the succeeding crowing, have been as violent as ever. The eye is still so downcast, that the sclerotic is constantly seen above the upper edge of the iris. The cervical glands are still greatly enlarged and indurated, as are also those in the direction of the clavicles. The gums being again much inflamed, I this day scored them freely and deeply, directed the continuance of aperients, and ordered the neck to be rubbed with ung. hydriodatis potassæ.

5th.—The crowing has been so much less frequent, and the attacks of breathlessness so much less severe, that the mother feels sanguine of the child's recovery. I dare scarcely hope for such a result. Medicines and ointment to be continued.

9th.—Has had very little crowing, though there have been "catchings in its breath." The appearance of the child is improved, and the glands diminished somewhat in bulk.

11th.—Had a bad day yesterday; the crowing and fits of breathlessness have again become more frequent, and the night otherwise has been disturbed.

14th.—Is reported by the servants to have had yesterday two such severe fits of breathlessness, that it was with great difficulty, and after the lapse of a considerable time, that the child partially recovered its breath with the crowing inspiration. Shorter interruptions to its breathing occurred throughout the day, succeeded by the crowing; several times in the course of the night the attendants were fearful of strangulation, and

once the mother thought the child had really expired. "It looked exactly like a corpse," "it looked just like death," were their expressions, without any "leading question" being proposed. Opening powders and iodine ointment to be continued. Liquor hydriodatis potassæ, with liquor potassæ, to be taken thrice a day.

17th.—Has again improved considerably. The nights have been very little disturbed by the complaint. The child looks altogether better. To-day the bowels have been somewhat confined. There has been more of the "crowing," but it is described by the mother as "nothing alarming."

26th.—Has continued much improved, but has still occasional catches in its breath and crowing; the former, however, are comparatively trifling, and the latter is less shrill. In the course of the night, it had only one slight attack. I heard one to-day, which was brought on by the child's crying whilst I was examining its gums. The sound convinced me that even during the attack the glottis is much more efficiently open. The glands near the trachea are sensibly diminished, and not very readily perceptible.

From this period until the latter end of March, the child was so much better, that my attendance was not required by the friends, nor did I hear more of it, excepting incidentally, that it continued to go on favourably. About that period, however, upon my return from a professional engagement in Essex, which detained me the whole night, I learned that I had been sent for, with an intimation, however, that, if I should chance to be from home, it would be unnecessary to inform me of it. After two days I called, when I learned that the symptoms had returned in all their violence, and the *parents believed* that in one attack the child had not breathed for a quarter of an hour. The child was now under the care of a very respectable practitioner in the neighbourhood, and I therefore left the case entirely to him. Not long after this, the practitioner was summoned in a hurry to this child, but it had died of suffocation before he could reach the house.

The parents, with great good sense, volunteered an oppor-

tunity of examining the body, and I was happy in being able to attend the inspection, which was conducted by Mr. Dodd, a very intelligent surgeon in Oxford Street. The parts, about the state of which I was anxious to inquire, were the head, and absorbent glands of the neck and thorax. When I first communicated this case, amongst others of the crowing inspiration, in the columns of a respectable weekly journal, it had not yet terminated. I represented it as still under treatment, and as affording ground for suspicion, that where there is head-affection combined with the crowing inspiration, the cause of the latter should be sought rather in the neck, or the thorax, than within the cranium; and at the conclusion of my report, ending Jan. 20, I stated my impression, from the inability to raise the eyes, that some cause of pressure, continuing from the time of the attack of convulsions in March, had probably affected the superior recti muscles. I expressed also my suspicion that this was not watery effusion, "seeing that the senses, internal and external, were all perfect, that the child was lively and intelligent, and the fontanelle not at all elevated;"² but that it was probably either some thickening of membrane, or glandular disease of, probably, a strumous character. The examination of the body proved it to be thickness and opacity of the arachnoid, with some degree of infiltration of the pia mater; but other interesting appearances presented themselves. The sinuses, as the skull, which exceeded the average thickness, was sawed through, appeared to discharge more blood than usual, but the arterial system was by no means gorged; on the contrary, the brain appeared to me to be more pallid than common, the vessels within its substance to be less numerous or less visible, and those upon its surface less turgid than usual. In several parts, there were small patches of the arachnoid which were slightly thickened and opaque, but without increased vascularity; and the pia mater was somewhat infiltrated with serum, more especially in the direction of the optic and motor nerves. The quantity of this serum, however, was inconsiderable, scarcely, if at all, exceeding what is commonly found after

² Medical Gazette, Feb. 15, 1834, p. 747.

death from strangulation, when there has been any considerable previous struggle for the recovery of the breath. The ventricles contained no fluid : their walls were in contact, and the choroid plexus pallid. The medulla oblongata and the nerves proceeding from its sides, were perfectly healthful. Towards the end of the dissection of the brain, a very minute quantity of bloody fluid gathered in the depressions of the occiput. This was, probably, merely the entangled serum from the pia mater stained with blood from the sinuses, which, being considerably less in quantity than we found in the pericardium and in the peritoneum, was in all probability the result of the recent, reiterated, violent, and long-continued attacks of asphyxia and crowing. Several glands were detected over the course of the recurrent on each side; and upon the left side, a little above the clavicle, that nerve was completely imbedded in a surrounding glandular mass. The bronchial glands were not sensibly enlarged. The mesenteric glands were very considerably enlarged and indurated.

Some might perhaps allege, from this detail of morbid appearances, that the child died of head-affection; but even if this were true, which neither the symptoms nor the mode of death at all tend to establish, the case fully realized my anticipations, that still the cause of the crowing inspiration would be found in the neck or in the thorax.

The effect upon two minute filaments, to the exclusion of others, of the motor nerves is an interesting pathological fact, which I have seen in three instances, where I believed there was some chronic morbid affection within the cranium, and illustrates the great advantage of minute anatomical research in investigating individual symptoms. It is known that the nerves of the superior recti muscles are the only filaments of the *motores oculorum* which separate from their trunks before they pierce the dura mater to enter the orbit; and being very minute threads, and therefore necessarily covered and protected by a proportionally slender neurilema, may well be paralysed by compression from thickened membrane, or even infiltration, when the more bulky trunk, covered with a

thicker elastic protecting membrane, may escape the injurious influence.

Many other cases of the dependence of this disease upon glandular enlargement, some of which I shall have occasion to mention hereafter for other purposes, have fallen within my observation, and I can assert with perfect confidence, that in considerably above twenty successive instances, with one exception only, I could trace the enlarged glands either from the commencement, or in the progress of the complaint ; they have been either distinguished during life or discovered after death. The single apparent exception I saw only once just before the death of the child, when I was unable to satisfy my mind upon the subject, although I thought, by pressure towards the sides of the trachea, that I could perceive faint traces of the irregularity of glandular enlargement under the deep-seated cervical fascia. The evidence, however, was not sufficiently distinct to enable me to pronounce with confidence in the affirmative, as to the existence of enlarged glands. I therefore mention the case as a possible exception, although the fat and waxy appearance of the child reminded me so forcibly of the first case which I have detailed, that I cannot help strongly suspecting, that, even if the cervical had escaped, the bronchial glands were probably enlarged.

I may now, therefore, I trust without arrogance, assume that enough has been said to establish the proposition, that at least a large numerical majority of instances of the crowing inspiration of infants are produced by the enlargement of glands, situated in the course and influencing the functions of the recurrent nerves, and even sometimes, probably, the par vagum. Some may perhaps be disposed to refer the disturbed state of the respiratory function in these cases to mechanical obstruction by direct pressure of the air tube itself producing a diminution of its area. But without entering minutely into this question now, I may content myself with alleging in anticipation of such an objection, first, that there is no evidence of such a diminution of the calibre of the trachea ; secondly, that infinitely larger tumours, as the *goître*, situated directly over the trachea, produce no such effects ; thirdly, that this

canal will bear a degree of pressure from a hard and circumscribed tumour, which may produce ulceration of its mucous membrane and ecchymosis, without the occurrence of similar symptoms ;³ fourthly, that the symptoms of this disease are not those of structural change producing mechanical obstruction of the trachea, as must be clear to all who are familiar with the phenomena arising from inflammatory deposits in that tube ;⁴ and, lastly, that the seat of the disordered function does not correspond with the seat of the actual disease, which are, in fact, out of the reach of each other :—and these considerations lead me irresistibly to the inference, that it can only be by nervous communication between the disease and the muscles of the glottis, that the contraction of that chink, upon which the breathlessness and crowing inspiration depend, can be produced.

³ Lawrence Med. Chir. Tr. vol. vi. p. 228.

⁴ See cases of Cynanche Laryngea, by Farre, Med. Chir. Tr. vol. iii. ; and by Perceval, *ibid.* vol. iv., and other practical writers upon the same subject.

CHAPTER II.

OF THE CAUSES OF THE DISEASE.

“Morbi absque præcognitione causarum nec præcaveri nec feliciter curari possunt.”—*Fernel. Meth. Med.*, L. i. Cap. 4.

SECT. I.—PREDISPOSING CAUSES.

IN investigating the causes of the laryngismus stridulus, it is peculiarly necessary to bear in mind the distinction, commonly observed in medical inquiries, into the remote and the proximate; the former being again subdivided into the predisposing and the exciting. Many have thought that, even the term predisposing cause should be excluded from the ætiology of disease, since it is some peculiar condition, either of the constitution or of an organ, which favours the action of a cause, rather than itself a cause. In point of metaphysical accuracy, the objection is possibly well founded, or, at all events, has some force; but in the sense to which I have restricted it, and as it has been commonly understood by medical men, there can be no sufficient objection to retaining it.

Age.—Amongst the various circumstances, which constitute a marked predisposition to this disease, is the period of life of the individual. All writers upon this malady, under whatsoever denomination they may have described it, agree in enumerating it amongst the complaints of infancy and childhood. Even those, who allow the greatest latitude upon this point, restrict it to within the age of twelve or thirteen years; and the most accurate amongst recent observers confine the period of its occurrence within still more narrow limits. Professor Hamilton, no mean authority upon such a subject, describes it as “the most formidable symptom, except convul-

sions, which occurs during dentition," and, as far as his observation has enabled him to judge, as "peculiar to the period of cutting the deciduous teeth." I have however seen this complaint at a later period, and have recorded one instance of its occurrence as late as four or five years of age, and a second, connected with extensive disease of the lungs, even at the still more advanced age of about six or seven. But the predominant portion of cases occurs unquestionably before the completion of the first dentition.

The greater prevalence of the disease during the first dentition is owing partly to the influence of causes which operate at this time, but cease to exist as the child grows older, such as affections of the surface of the head, including excoriations behind the ears and *crusta lactea*, and inflammation of the gums or alveolar processes from teething; and its all but exclusive occurrence before the age of twelve and thirteen, is probably to be referred to the size of the larynx at that time. It is well known that this organ, at once of the voice and of breathing, for a while grows only in proportion to the growth of the body. Like the heart, great vessels, and other internal organs, it becomes a little larger as the body increases in size; but as the child approaches towards the age of puberty, the laryngeal portion of the air tube, like the sexual system, undergoes an enormous alteration; much greater indeed in the male than in the female, but in both very considerable. The extent of this change has been subjected to a calculation, the elements and details of which, however, have not been specified, by Richerand, who has obtained as "a general result, that between the larynx and the glottis of a child of three or of twelve, the difference of size is very inconsiderable and cannot be estimated by the height of the figure;" "that at the epoch of puberty, this organ of the voice enlarges rapidly;" "that in less than a year, the opening of the glottis increases in the proportion of five to ten;" and "that these changes are less remarkable in woman whose glottis increases only in the proportion of about five to seven." Hence then it is, that, in early life, a cause, which by its influence may partially close this small chink,

will occasion a sonorous inspiration ; but, as it grows larger, although great distress in breathing may be produced by similar causes, if in an aggravated degree, the sound is very rarely observed ; and hence also it is, that in women, whose glottis only increases in the proportion of two-sevenths of its infantile size, the symptom, or something bearing a very close resemblance to it, occasionally occurs, as has been observed, in hysteria.

That age, then, constitutes a very important consideration in calculating the chances of the occurrence of this disease, has been established by the accumulated observations of a continuous line of practitioners for above two thousand years. It is a fact which admits not of dispute, and is principally the result of two important circumstances connected with infancy and childhood, the relative size of the glottis, and the greater frequency of the exciting causes. Capuron and others add to the agency of these causes, the nervous constitution and excessive sensitiveness of infantile life. “ Les enfans sont très sujets à cette maladie, car leur constitution nerveuse et leur mobilité excessive les y disposent naturellement.”¹ But this is one of those general statements or *dicta* of the profession handed down to us from our predecessors, commonly received, with little explanation and less examination, as a truism unquestioned and unquestionable, and to be adopted as a principle or law of the economy calculated to explain, or at all events to bind together many otherwise distinct, and in some instances even discordant, facts. I believe, however, that upon scrupulous examination the doctrine will be found to amount to little more than the bare assertion, that, from causes which produce no such effects in the adult, convulsions are not uncommon in infantile life. But conceding that, as a general proposition, it is true to its full extent, it will be necessary, before we can apply the dogma in explanation of the crowing inspiration of infant children, to prove that this laryngeal affection is, in point of fact, a peculiar kind of convulsion.

Constitution.—A constitutional tendency to this complaint

¹ Malad. des enfans, p. 438.

may occasionally be traced in whole families. This has been expressly stated by some, incidentally noticed by others, and coincides with the results of my own observations.

Mr. Pretty illustrates this by referring to his own family, three of whom were attacked in succession; and he alludes to another family in which, also, three were successively the subjects of the disease. Mr. North mentions an instance in which three children in the family were successively attacked; and Dr. Henry Davies announces it as a general truth and records an instance of it in these words; "This disease seems to me peculiar to some families. I have now a patient whose mother has lost three children by it." My own experience amply confirms these statements. The only sister of the child, whose case, the first that I have related, led me to investigate more minutely the history and phenomena of this disease, has been attacked with it more than once in its milder forms; and a third has since died in the country, and, as far as I am able to judge from the accounts of friends, of something similar. The elder and only brother of W. C., was, during many months, occasionally under my observation and care on account of the same malady; and another remarkable instance was mentioned to me recently by a lady whom I was attending in her confinement. Her own child, only a fortnight old, had an occasional hissing noise in its breath, apparently, from mucus hanging about the entrance of the larynx, on account of which the mother begged my permission to administer an emetic. The symptoms, however, did not appear to justify so harsh an expedient, and I therefore withheld my sanction from its employment. I was then pointedly asked whether this peculiar sound indicated a threatening of, or tendency to, croup, an inquiry to which, in the absence of fever, of cough, of catarrhal symptoms, of any permanent distress in breathing, and of the croupy inspiration, I had no hesitation in replying in the negative. It was then suggested to me for consideration, whether this sound in breathing might not have been the result of an impression upon the parent's mind, during pregnancy, in consequence of her assisting in the recovery of a child of one of her nearest relatives from a fit of croup, which

threatened suffocation, and to which *all the children of this, a very large family*, had been subject from time to time during teething. Although I could not assent to the probability of this, yet the statement interested me; and to my inquiry whether these children were subject to glandular enlargement in the neck, the mother of my little patient, without the slightest reserve or hesitation, replied in the affirmative; they were all, she assured me, particularly liable to such affections, and she had herself observed them during the attacks of croup.

Climate and Season.—The constitutional proneness to this complaint is much under the influence of climate and season. In dry elevated situations and warm climates this disease is little known, and hence it is that many of the German and some French writers, who have gathered what slender information with regard to this disease they possess from the work of Millar, have much indulged in controversy upon the distinction betwixt this disease and the true croup, and very commonly pronounce for the identity of a disease of which they know little or nothing,—the asthma of Millar,—with another abundantly familiar to them,—croup; thus laying themselves open to the obvious reproach of not paying sufficient attention to the works of authors of other countries, and to infantile diseases. So M. Albers, one of the successful competitors for the prize offered by Napoleon for the best essay on croup, after assuring his readers that he had never seen Millar's asthma, more than hints that this celebrated English writer had mistaken the early stage of croup for some other malady, which he has designated asthma. M. Albers thus presents in his own person an indifferent example of the caution, which he inculcates in others, when he pronounces definitively that the symptoms of the first stage of Millar's asthma are no other than those of croup, arising suddenly without preceding catarrhal symptoms.² The same observation which I have

² "Est autem medico imprimis cavendum, ne ea neget, quæ ipse non viderit. Igitur equidem non diffiteor existere posse illud asthma Millari, etsi nunquam observavi."....."Quod si Millari descriptionem asthmatis, quod acutum vocat, accurate perlegimus, manifesto cernimus confusionem asthmatis illius, cujus existentiam in dubium vocamus, et tracheitidis, quam commisit. Signa

made with respect to M. Albers, applies equally forcibly to his nephew, Dr. J. Christ. Albers. Residing in the same town, Bremen, with his uncle who had never seen Millar's asthma, it is not probable that his opportunities of observing it could have been more favourable or extensive, and yet he has written an essay, the sole object of which is to prove, that Millar was mistaken when he supposed that he was describing a peculiar malady distinct from the inflammatory croup, the "*suffocatio stridula*," of Home; and this, together with a want of that spirit of candour which should animate the philosophical inquirer after truth, is abundantly sufficient to vitiate any conclusion at which he may arrive upon the subject.³ How much more candid is the spirit which has dictated the following acknowledgment of M. Double! who remarks that the acute spasmodic asthma of infants has resemblance to several other diseases, especially croup, and angina pectoris; that though unfrequent, it is not very rare; and since numerous cases of this disease have been recorded, and treatises written by English, German, Swedish, and Italian physicians, it is beyond doubt astonishing that one solitary instance only of this malady has been recorded, at least as far as he is aware, by French physicians. "It is difficult," he adds, "to explain this; at the same time, it may be remarked, that French physicians have written very little upon the diseases of infants, and that they have principally borrowed from the

enim, quæ primo stadio asthmatis propria esse dicit, non alia sunt quam tracheitidis repente orta absque prægresso catarrho."—Comment de Tracheitide infantum, vulgo croup, vocata, p. 50.

³ The instances of this want of candour are numerous; I may select two. Millar had given with great minuteness the details, from its commencement to its termination, of a case, without even introducing the word "cough;" but M. Albers in his observations upon this case says, "*quamvis Millarus tussim solummodo leviter tetigit, certum tamen videtur, eam in fine morbi adfuisse; cuncta enim, jam supra monuerat, symptomata apparuisse fortiora, ergo quoque inter cætera tussim,*" &c. (p. 34.) And again commenting upon two other instances, recorded without the mention of cough as a symptom: he says, "*Quisque certe mirabitur, auctorem nec minimam tussis fecisse mentionem, unde tamen certo concludere non possumus, nullam ideo adfuisse tussim.*"—Joann. Christ. Albersii, Comment. de diagnosi Asthmatis Millari. Gottingæ. 1817.

observations of physicians of other nations.”⁴ The German and French writers are well acquainted with croup, because it is no uncommon complaint in countries where cold dry winds obtain in the winter, the spring, and the autumn; and they think that the asthma of infants is but a modification of that complaint. But in the south of France, especially near the shores of the Mediterranean, where in the winter season they are much exposed to damp, the asthma of infants is well known; M. Baumes, the Montpellier professor, was familiar with it, and it has been described by M. Mauciers, who seems also to have resided at Montpellier, under the designation of the “*catarrhe suffocant nerveux*.” Again, an opposite error has been committed by one who seems to have met with this disease, but must have been altogether ignorant of croup. M. Gervino who practised in Piedmont, (*quasi ad pedem montium*,) in a low, swampy situation where rice is grown and constitutes one of their principal agricultural productions, describes the laryngeal constriction with which he was familiar, but applies to it the name of croup, to which disease, as described by writers, he must have thought it to bear the nearest affinity. It is probably to the change in the American climate, in consequence of the inhabited parts of that country being more cleared of its forests of timber, and its greater immunity, therefore, from diseases the result of fogs and damps emanating from the decay of vegetable matters, that the earlier American writers speak with so much confidence of this disease, whilst now they doubt its very existence; and this also probably accounts for the changes of opinion which Rush successively adopted in the intervals betwixt the publication of his letter to Millar in 1770, the publication of his first edition of *Inquiries and Observations* in 1794, and that of the second edition in 1805, with regard to this disease and its relation to croup.

In the same country the difference of season has a most ma-

⁴ On peut cependant remarquer, en général que les médecins français sont peut-être ceux qui ont le moins écrit sur les maladies des enfans : à quelques dissertations particulières près ils n’ont guère fait que profiter des observations des médecins des autres nations.”—*Double Traité de Croup*, p. 323.

terial influence upon the frequency of this disease. In this country, what sportsmen call an open season, the combination of damp with a degree of cold short of the production of frost, remarkably increases the tendency to the complaint. In the winter of 1833-4, if such, in the absence of frost throughout its whole course, it may be called, this laryngeal affection was extremely prevalent. During an experience of twenty years in this metropolis, I never saw or heard of so many cases; and from conversation with my professional brethren I find that the observation has been general. Millar has made a similar observation with respect to the influence of season and situation, for the disease occurred in the lower parts of the district in which he resided, in which "there was a clay soil that held the moisture," "and in the autumn after a very wet summer, in which the harvest was very late and the grain much injured;" and he fortifies his statement by the unbiassed, though unprofessional, testimony of a clergyman who kept a register of the weather for fourteen years, and who observed that the asthma was generally more frequent in spring and autumn, in moist seasons and changeable weather, and when the mercury stood low in the barometer.

The constitutional tendency, thus engendered by damp situations and seasons, is materially aggravated by all great and sudden vicissitudes of temperature, and hence the disease is so common in this country.

Even amongst the most respectable classes of society the children are any thing but exempt from these "skyey influences," their nurseries being but ill protected against such sudden alternations. Children are generally kept in low apartments at the summit of the house, (in the attics as they are called,) with very imperfect protection from the heat of the day, from the inclemency of the night, or from any sudden variations of temperature. Such an arrangement cannot be too severely deprecated. The senior members of a family enjoy themselves, during the comparatively short period devoted to their bed, in spacious, well-ventilated, well-protected chambers; whilst their children, in a London winter, are often for weeks together and during the greater part of

the day and night, huddled together in such apartments as I have described, which can little contribute to their health.

Amongst the lower classes of society, the inhabitants of the underground apartments, at once damp and ill-ventilated, are more subject to this disease than others. This was particularly observed by Mr. Moss of Liverpool, who speaking of the asthma of children says, "it is most commonly met with in the children of the poor who inhabit cellars;"⁵ and I have related one striking example of this in a child, who was attacked whilst living in a low damp kitchen, was benefited by removal to the second floor, and permanently cured by being sent to Clifton.

Diet.—Indiscretions in diet, also, notoriously aggravate the disposition to this complaint. Millar tells us that "the asthma most frequently seized those who had been lately weaned, and its violence fell principally upon the lower class of people, on those who were of a heavy, leucophlegmatic constitution, who had a voracious appetite, and whose diet consisted of crude watery vegetables; though children who were healthy, well-proportioned, and moderate in their diet, were not entirely exempted."⁶ The same general influence of bad feeding may also be inferred from a previous statement by the same writer that the asthma appeared after the summer of 1755, when a great quantity of rain fell, the harvest was wet and late, and *the grain much damaged*"⁷—and as bread is the principal article of diet amongst such children, it may be safely concluded from such state of the grain, that they must have been defectively nourished. But errors in diet, with respect both to quantity and quality, are not confined to individuals in the humbler walks of life. Such errors are so notorious as scarcely to require proof, and Mr. North, who is eloquent in denouncing these improprieties of management, mentions an instance in which he believed the disease to have been intimately connected with derangement of the digestive organs.⁸ Dr. H. Davies, although cautious in his statement, thinks, that "improper feeding is

⁵ Essay on the Management and Nursing of Children, p. 263.

⁶ Millar on the Asthma, p. 14.

⁷ Ibid. p. 11.

⁸ On Convulsions of Infants, pp. 92 and 271.

no doubt often an occasional cause of this disorder ; and in the case narrated, if there had not been some unusual appearance of the brain, something might have been attributed to over-feeding the child each day with panada.”⁹

Scrofula.—Amongst the predisposing causes I have hitherto confined myself to those which, all are agreed, will produce a tendency to this peculiar malady without reference to any other disease. It may however be doubted whether this proneness does not generally resolve itself into a mere disposition to scrofula. My own experience would justify my deciding in the affirmative, and this opinion derives material support from the fact, that the causes which thus aggravate, or produce, the disposition to the crowing inspiration of children, are precisely those which call into action a strumous diathesis. So, not to multiply authorities upon a point which will scarcely be disputed, or to refer to any recondite works upon the subject, I may content myself with the confirmation afforded by the industry and research of a popular writer upon physic, who enumerates as the causes of “scrofula,” a “cold and humid climate, variable seasons, unsteady weather,” “temporary exposure to wet and cold,” “breathing impure and tainted air,” “living upon food of an unwholesome and indigestible nature which does not afford due nourishment to the body,” “neglect of cleanliness and of salutary exercise, indolence, inactivity,” “the want of warm clothing, confinement in cold damp habitations,” and lastly, “hereditary disposition.”¹ The similarity and even sameness of the circumstances which thus increase the tendency, at once, to the constriction of the glottis in infants and to scrofula, the great characteristic of which is glandular enlargement, would render it highly probable that there was some essential connexion between the two, even if there were no more direct and conclusive evidence upon the subject. There are, however, not wanting facts and opinions in favour of this connexion. In the case of A. W., already related,² the patient had passed the age of teething, there was no irritation upon the surface, and no suspicion of ex-

⁹ Med. Rep. vol. xviii. p. 117.

¹ Thomas's Practice of Physic. Ed. 5. p. 517.

² At p. 30.

citement in the interior of the cranium, and yet the glandulæ concatenatæ were very greatly enlarged; and in proportion as these subsided or disappeared, the disorder of the respiratory function became milder, and gradually vanished. She was the child of unhealthy parents, lived in a damp kitchen, was benefited by removal to a more healthy apartment, and ultimately cured by being sent to the higher part of Clifton. It can scarcely be doubted that in this case there was a decided scrofulous disposition, and it is upon this probably, that the exciting causes generally act, thus verifying the remark of Dr. Marsh, that "all the cases of this disease, which he had witnessed, had occurred in children either themselves exhibiting marks of the strumous diathesis, or sprung from scrofulous parents."³ As a simple pathological fact, I have already traced the association of the croupy inspiration with glandular enlargement; and an investigation of the existing causes will, if I mistake not, be found to afford material countenance to the opinion, that this association bears the relation of cause and effect.

SECT. II.—EXCITING CAUSES.

Dentition.—The most judicious writers upon this disease concur in the assertion that it has much to do with the process of teething. So Primerosius, Etmuller, and Hoffman enumerate the asthma amongst the diseases connected with dentition; and the least speculative writers since their time have generally entertained a similar opinion, and recommended the use of the gum-lance amongst the earliest and most important remedies. Professors Burns and Hamilton both describe it as taking place "during dentition," the latter of these writers as "peculiar to the period of cutting the deciduous teeth," and Mr. North, as "in many cases immediately connected with painful dentition." Dr. Clarke is not very decisive upon this point, though he had evidently some vague notion of the connexion of the disease with dentition, for he tells us that it "seldom, if ever, occurs after the expiration of the third year of a child's

³ Dublin Hosp. Rep. vol. v. p. 617.

life, and not often in children who have lived by sucking, *till they have teeth*, and have never taken animal food till the dentes cuspidati have come through."

Of the frequency of this connexion there cannot be a question; but it is not every case of painful dentition that produces the crowing. I have had recently under my care a professional friend's child, whose gums, when I first saw her, were more expanded and inflamed than I ever recollect to have seen them. This condition had produced great feverish excitement, very frequent and disordered stools, and immense distension of the intestinal canal; but without more distress in breathing than what would result from the abdominal distension, and without the slightest disposition to crow. There was in this case enough of "painful dentition," enough of distended and disturbed alimentary canal, to produce the morbid constriction of the glottis; yet though the father was full of anxiety and apprehension for her safety, and considered the case all but hopeless, there was no crowing. This is one amongst numerous instances in which I have known the gums immensely enlarged and inflamed until they resembled segments of cherries, in which the slightest touch has produced great pain, causing the child to scream continuously for a long time, in which the lips have partaken of the swelling, and there have been violent feverish symptoms, or formidable diarrhœa, or even general convulsions; and yet this symptom has been absent. It would seem, therefore, that some intermediate change, which teething produces in some, not in others, is requisite for the production of the crowing inspiration. The observation of Cruikshank that the glands of the absorbents of the neck frequently "swell in children from inflammation of the gums and alveolar processes in teething, and recover after the teething is over," might have led to the suspicion that such swelling of the glands constituted that intermediate link in the chain of events, and experience and observation abundantly confirm the suspicion. Scarcely an instance has occurred to me, since my attention has been very strongly directed to the subject, in which there has not been the strongest foundation for the belief that either

the glandulæ concatenatæ of the neck or the thoracic absorbent glands have become morbidly enlarged.

In these cases, dentition is analogous in its influence to that of any other cause of local irritation, common or specific, upon glands situated in the course of those lymphatics, which lead from the part excited or inflamed to the venous circulation in which they terminate. Amongst the most familiar examples of such influence are a scratch or other mechanical injury of the finger or hand occasioning enlargement of one or more of the axillary glands, chafing of the foot or nates producing a sympathetic bubo, cancer of the uterus enlarging the lumbar glands, or, if it extend to the vagina, occasioning a crop of inguinal gland not only sensible to the touch, but even abundantly visible. So, the inflammation of the gums, or alveolar processes, or enveloping membrane of the teeth, may produce morbid excitement of those glands in the neck, through which the lymphatic vessels from the teeth and gums are passing to their ultimate destination, and cause their enlargement even in the absence of all strumous taint; but still more certainly if such taint exist. This explains the fact noticed by Hamilton, that the complaint has "appeared in the most robust as well as the most delicate infants," and the statement of Etmuller, that it is a complaint of children "plus minusve robustorum."

Inflamed Scalp.—If it be true, that it is by the intervention of glandular enlargement that dentition occasions in some children, not in others, the croupy inspiration, it might be anticipated that other causes capable of producing similar enlargement might occasion the same symptom; and experience bears me out in the assertion that it is so. I have mentioned two examples of this kind, where the remote cause was an inflammatory affection of the integuments of the face or head; and we have the highest authority for saying that "the glands of the absorbents of the neck frequently swell and enlarge from suppurations, and ulcerations of the integuments on the top of the head."⁴ This connexion has been rarely noticed, although it has not altogether escaped observation. It is slightly adverted to both by

⁴ Cruikshank, Op. Cit. p. 230.

Hoffman and by Dr. Molloy, the latter of whom says, "Some have tumours behind the ears, which mortify. Many have a prodigious weeping behind the ears, which is very corrosive."⁵ Hoffman, in his allusion to it, explains it in a way, which is neither satisfactory to my mind, nor consistent with the observations which I have had an opportunity of making upon the subject. In conformity with the prevailing notions of his time, and even with a very common impression in our own day, he considered the "*asthma quasi suffocativum*" of infants, (like convulsions and some other of their ailments,) to be owing to the repulsion of acrid matters upon the sudden disappearance of eruptive ailments, rather than to the irritation of existing eruptions. In conversation some years since with a general practitioner⁶ of great natural shrewdness and very enlarged experience in eruptive diseases, he assured me that reiterated experience had satisfied him, that, where convulsions were associated with such complaints, they were the result, and commonly in proportion to the extent of the local excitement; that they had no reference whatever to the retrocession or repulsion of these eruptions; that they ceased as these appeared less angry or disappeared; and that in such cases the best mode of obviating the occurrence of convulsions or other serious ailment, was to cure the eruptions as speedily as possible. My own more limited experience in such complaints long since forced upon my mind a similar conviction, though not without a very essential modification of his statement, founded upon the necessity of attending to any internal cause, of which the eruption and the convulsions may have been the compound result, and of establishing some vicarious discharge, especially by the bowels, where the constitution has been long accustomed to the drain from an extensive surface, whether from the discharge of *tinea capitis*, *crusta lactea*, or excoriations behind the ears. It is with these affections in children as it is with issues, setons, piles, or other habitual discharges in the adult. The sudden drying up of the latter constitutes a

⁵ Rutt's Chronological History of the Weather, Seasons, and Diseases of Dublin, p. 112.

⁶ Mr. Kelson, late of Seven Oaks.

very important feature in the ætiology of inflammatory diseases, and its effect requires to be counteracted by some less obnoxious mode than the occurrence of disease; sometimes by taking small quantities of blood, but, still better, by the use of aperient medicines and the regulation of the diet.

But, whatever may be said of the relation which true convulsions bear to these eruptive ailments, at least as far as the constriction of the glottis (the convulsive character of which is problematical) is concerned, the two cases which I have related cannot be reconciled with the opinions upon the subject entertained by Hoffman, Clarke, and others. In those, the eruptions upon the face and scalp, and the excoriations with erysipelas and acrid discharge behind the ears, were the remote cause of the disease; not by retrocession or repulsion, but by the extension of irritation, through the lymphatics of these surfaces, to the contiguous absorbent glands in their course. These local causes of excitement produced no crowing till they had produced enlargement of the glandulæ concatenatæ; when the crowing was violent, the increase of size of these glands could be distinctly traced throughout their whole course; as the inflammatory state of the integuments was subdued by soothing applications and gentle aperients, the glands subsided, and the reduction in bulk was attended with a proportionate diminution of the functional derangement of the glottis; until at length the fits of asphyxia, the crowing inspiration, the occasional strangling cough, and the mucous rattle in respiration, (all parts of the same morbid affection,) declining *pari passu* with the diminution of those glands situated in the course of the trachea, the entire disappearance of the latter was attended with the total cessation of the former, and this, notwithstanding that numerous tumid glands remained at the upper part of the neck behind the posterior edge of the sterno-cleido-mastoid muscles. But the glands required some little time after the disappearance of the eruption completely to resume their original form and size, and, during this interval, a remnant, as it were, of the symptoms remained. It is upon the same principle that I would explain the fact, noticed by Mr. North, which has abundant

foundation in fact, that, when this complaint arises from painful dentition, "the symptoms do not vanish instantaneously, as if by magic, the moment a tooth starts through the gum. They pass off gradually." In other words, after the gum and enveloping membrane of the tooth have been relieved from swelling and inflammation by the free use of the gum lance, some time is still requisite for the irritation and tumid state of the cervical glands to subside.

Head Affection.—Another cause, formidable in character, but luckily not very frequent in operation, is some diseased condition within the cranium. Whether simple sanguineous congestion is sufficient for the production of the disease, is at least questionable. The affirmative has, indeed, been asserted upon high authority, but my own experience affords no countenance to the opinion, as in all the cases of a combination of general convulsions with the crowing inspiration of children, which I have had an opportunity of examining after death, there have appeared such thickening and opacity of the arachnoid, as to leave no doubt of the prior occurrence, not only of vascular turgescence, but of actual inflammation.

The existence of some association of the laryngeal constriction of children with cerebral disturbance appears to have been more than suspected from a very remote period. Hippocrates represents the asthma of children as sometimes connected or confounded with epilepsy; Galen assents to the truth of this observation, and comments upon the passage in the writings of the "divine old man," in which the statement is contained; and Etmuller treats of the "*catarrhus suffocativus cum metu epilepsiæ junctus*." But although there are these early traces of a knowledge of some affinity between these two diseases, subsequent writers have been much divided upon the subject. Amongst the most strenuous and original advocates for the universality of the connexion, is the late Dr. Clarke, but his statement is wanting in that perspicuity which usually characterizes his writings, and his proofs are altogether defective.⁷ Dr. Henry Davies represents most authors to "agree as to the brain being the seat of the dis-

⁷ Comment, p. 90.

ease, though it is not ascertained on what condition of it the particular train of symptoms depends;⁸ this opinion is sanctioned by the adoption of the reviewer of Dr. Mason Good's "Study of Medicine," in the Medical Repository;⁹ and so confident upon the same point was Mr. Pretty, who has been painfully interested in this disease, that he has given to it, or adopted, the designation of "cerebral croup."¹ Golis considers it "amongst the predisposing causes of the hydrocephalus acutus,"² whilst his translator Doctor Gooch says, "As spasm evidently accompanies it, and as it often goes on to convulsions, it seems more probably an affection of the brain."³ Mr. North concedes that "in connexion with this disease we may have sufficient evidence of cerebral derangement to justify a vigorous and prompt mode of treatment," but adds that "in the great majority of instances we have no proof of affection of the head;"⁴ and Dr. Marsh, one of our latest and best authorities upon the subject, whose opportunities of seeing this complaint amongst the ill-fed, ill-clothed, ill-housed applicants for relief at his dispensary in Dublin, must have been extensive, maintains that "it is more than doubtful whether in this affection, at its commencement, the brain be at all involved."

That these laryngeal and cerebral affections occasionally co-exist, my own experience enables me to affirm, and is confirmed by the observations of others; but no one, as far as I have been able to ascertain, has attempted to investigate the nature of this relation. Dr. Clarke and his followers believe the state within the cranium to be one of pressure from vascular fulness; that this is the cause of a spasm or convulsion of the closing muscles of the glottis, and that the influence is direct. Analogy and observation, however, afford

⁸ Lond. Med. Repos. vol. xviii. p. 116.

⁹ Ibid. p. 416.

¹ Lond. Med. and Phys. Journ. vol. lv.

² A Treatise on the Hydrocephalus Acutus, p. 71.

³ Gooch's Lectures by Skinner, p. 338.

⁴ On the Convulsions of Infants, p. 262.

⁵ Dublin Hospital Reports, vol. v. p. 620.

little countenance to this opinion. In cases of acknowledged fulness of blood in the vessels of the head, as in that state of the cerebral circulation which precedes and threatens apoplexy, the symptoms are much more frequently characteristic of defective nervous energy than of an excited state of the "nervous centre." There may indeed be head-ache from vascular turgescence under such circumstances of cerebral pressure, but the rest of the symptoms are generally more allied to paralysis than to convulsion. So there are commonly somnolency with stertorous breathing during sleep, sometimes depression of one, or both, of the upper eye-lids, often a sluggish and dilated pupil, with indistinctness of vision, black spots before the eyes, or even occasionally complete amaurosis, embarrassed speech or peculiarly slow articulation, the tongue not readily obeying the mandate of the will, numbness and tingling about the hands or feet, and, very frequently, an impaired state of the intellectual faculties, especially defective memory. It is probably not until inflammation has supervened that convulsions occur. Such, at least, is the conviction forced upon my mind by an extensive examination of recorded cases of affections of the head, and it coincides completely with the results of my own observation.

Cruveilhier is almost the only author, with whose writings I am familiar, who has noticed with any distinctness this important distinction between the effects of compression, and those of irritation of the brain. To the former he ascribes drowsiness, diminution of sensibility and voluntary muscular movements, a blunting of the intellectual faculties, slowness and inequality of the pulse and of respiration, dilatation of the pupils, and palsies either partial or general; to the latter he refers the intensely violent head-aches, vomiting, violent and sudden exclamations either articulate or inarticulate, abnormal movements, sudden waking in a fright, unusual and odd positions, delirium, partial or general convulsions, grinding of the teeth, unsteady movements (oscillations) of the pupils, flushes of heat upon the face, fever, &c. He states further, that the symptoms referable to compression constantly arise at the commencement of the "*maladie cérébrale*,"

and he has traced this cerebral malady to affections of the chest, accompanied with glandular enlargement. "Je possède quatre observations de maladie cérébrale consécutive à des phthisies pulmonaires avec tuméfaction énorme et suppuration caséuse de ganglions lymphatiques, thoraciques et abdominaux. Dans deux cas, elle débuta par une céphalalgie intolérable, dans les deux autres par un assoupissement. Chez tous, la respiration prit ce caractère d'irrégularité, qui annonce que le besoin de respirer est difficilement senti par le cerveau, ou que l'influx cérébral est moins librement transmis aux muscles inspireurs." ⁶

Lieutaud, in his chapter entitled "*Læsiones Capitis*," has put upon record no less than twenty-six instances of cerebral disease. In six only of these convulsions are enumerated amongst the symptoms; and in all of these six inflammation was manifest, going on in three of the cases to the suppurative stage. The "researches" also of Dr. Abercrombie satisfactorily establish the conclusions he has drawn from the interesting examples which fell within his own observation, that "in the state of simple inflammation, the affection seems in general to be characterized by head-ache and convulsions," and that "in some of the cases which terminated in encysted abscess, there is reason to believe that *the inflammatory stage* was characterized by convulsion of one or more limbs, followed by temporary paralysis; and that the permanent paralysis occurred when the disease passed into suppuration." ⁷ But although these, and numerous other similar facts which might be adduced, concur in proving that inflammation of the brain produces convulsion, and at the same time render it doubtful whether convulsions occur from any structural change which does not include inflammation as part of its essence, yet they have little tendency to warrant the conclusion, that either in children or adults, such inflammation (and much less mere vascular congestion) exercises any direct or peculiar

⁶ Médecine Pratique éclairée par l'anatomie et la physiologie pathologiques, par J. Cruveilhier. 1821, p. 14, et seq.

⁷ On the Diseases of the Brain and Spinal Marrow, p. 114.

influence upon the muscles of the arytaenoid cartilages. The most extensive and even fatal meningitis,⁸ inflammation of the cerebral texture going on to suppuration or “ramollissement,”⁹ nay, suppurative inflammation of the medulla oblongata itself,¹ from which the laryngeal nerves, through the pneumogastrics, derive their origin, may occur without producing a single symptom referable to the condition of the glottis. That peculiar state also of the cerebral circulation which is so apt to end in serous effusion, the acute or chronic hydrocephalus of authors, may go on to the extent even of bursting the brain and its membranes,² without producing the so called spasm of the glottis upon which the crowing inspiration is universally believed to depend, and which is not even a common symptom of that complaint. Had it been a general or even frequent attendant upon cerebral excitement or erethism, (as it has been denominated by Dr. Nicholl),³ or of hydrocephalic effusion, a symptom which addresses itself so forcibly to a sense, now much employed in discriminating the diseases of the respiratory organs, could not have escaped the observation of such acute writers as Quin, Fothergill, Whytte, Cheyne, Carmichael Smyth, Yeats, Nicholl, and a crowd of other authorities both in this country and upon the continent; nor would Dr. Clarke himself have failed to enumerate it amongst the symptoms in his chapter “on convulsions,” or in that on the “phrenitis of children.”

These considerations lead me to disbelieve the *direct* operation of cerebral pressure, excitement, inflammation, or effusion, in producing this “peculiar convulsion of infant children;” and yet the two occasionally occur in combination, and the relation between the two may be that either of cause, coincidence, or consequence.

In those instances of the association of these two maladies in which the symptoms of head-affection precede those of the laryngeal obstruction, it is not improbable that the morbid condition within the cranium may be the indirect cause of that

⁸ Abercrombie, Op. Cit. sect. 4.

⁹ Ibid. sect. 5.

¹ Ibid. sect. 5, § 12.

² Med. Chir. Tr. v. 8, p. 51.

³ Practical Remarks on Disordered States of the Cerebral Structures occurring in Infants. By Whitlock Nicholl, M.D.

imperfect opening of the glottis which occasions the crowing. The case of W. C., related in another part of this essay, was probably of this kind.⁴ There were, in that instance, not only fulness of vessels and infiltration of the pia mater, but also thickening with opacity of the arachnoid membrane; and the symptoms of cerebral disturbance were prior to the occurrence of the crowing inspiration. There were also symptoms of pressure continuing from the time of the convulsion, but so slight as to manifest themselves exclusively upon those slender filaments of nerves; which, separating from the trunk of the *motores oculorum*, proceed in an insulated form from within the cranium to supply the levator muscles of the eye.

The interesting example, also, of this disease recorded by my friend, Dr. Henry Davies, was probably similar in kind. This child, born after a labour of two days' duration, had on the following day a *fit*. "He then did well for four months, but on the 26th of December was attacked with a fit, characterized by bending the body forwards, pushing out the hands as if to ward off something, then starting, and stretching the fingers as if frightened. The eyes were fixed and the face purple." "The paroxysms occurred once or twice a week, till the beginning of March, when they became more violent, and were accompanied by a peculiar and sonorous inspiration, threatening suffocation." Benefit was at first derived from the measures employed; "the fits, however, at length, returned in quicker succession, and were more severe; they occurred to the extent of several in an hour." "There was no appearance of teeth." The child lived about a fortnight after it was placed under the care of Dr. Davies, but the mode of death is not stated.

The only diseased appearances noticed, with the exception of a greater than ordinary size of the thymus gland, were connected with the cranial cavity; the head was larger than usual, the right parietal protuberance being more prominent than the left; there were slight infiltrations of the cellular texture between the pia mater and the arachnoid membrane, considerable congestion of the veins of the pia mater, a softened texture of brain, two ounces of fluid, perhaps more, in the ventricles,

⁴ Page 41.

and "in the right ventricle the interior part of the corpus striatum was somewhat prominent, the surface granulated and of a caseous texture to about the size of a walnut."

The last of the morbid changes above described, I consider as by far the most important, and probably the cause of the whole series of events. They appear to me conclusive as to the existence of inflammation, beginning, apparently, in an acute form immediately after birth in consequence of the long continued pressure upon the head, and then, as in Dr. Abercrombie's cases in the adult, producing a convulsion; afterwards assuming a more chronic form, ending in ulceration, apparently scrofulous, of the corpus striatum with change of structure of the surrounding cerebral texture; and raising in its progress, during the development and growth of the cranial bones, the parietal protuberance of the same side.

It is not improbable, also, that the second case related by Mr. Pretty may have been similar, as that began with a convulsion. But it is impossible to speak with confidence upon the subject, because the nature of the convulsion is no further described, than that it was followed by repeated paroxysms of croupy and impeded respiration which threatened the production of another.

In a communication also to the Medical Gazette, (vol. xiii.) by a very eminent practitioner in one of our great manufacturing towns, where it may be expected that this disease would not be uncommon, is a case in which it appears probable that the same relation obtained. In this case, "four hours after birth, the child was suddenly taken with general convulsions, in which he continued twenty hours; that is to say, he was at no time during that period so free from them as to be able to swallow." After the following morning, when he swallowed some cream and water, he appeared a vigorous healthful child with a peculiarly early development of mind, and continued so until he was nineteen weeks old, when, for the first time, February 14th, he awoke from sleep with carpo-pedal contractions, and slight crowing, and had on the next day what the nurse called "a fit," in which he continued only two or three minutes. It commenced with repeated crowing, followed by rigidity of

the limb, and a degree of twitching about the mouth. After the lapse of a very few minutes *he stared and took no notice*. On the day following, after the judicious employment of remedies, including a leech a grain of calomel and castor oil, he was quite merry and apparently in all respects well. There was an itchy eruption on the scalp which teased him a great deal, and it was thought he was beginning to teethe. His attacks were repeated on the 21st and 22nd, again on the 28th and on the 3rd of March, and upon the following day, “at five o’clock, while on the nurse’s knee smiling at one of the servants who was talking to him, he began crowing loudly, became black in the face, and by the time Mr. Robertson got to the nursery, which was little more than one minute, he was pulseless, and showed no sign of life except a slight twisting of the mouth. *He appeared to die as if he had been strangled with a cord, only much more quickly.*”

In this instance, again, the first in the series of phenomena, was the occurrence of general convulsions, probably from some inflammatory affection of the brain induced by the labour; this was at length succeeded by the laryngeal affection which ultimately destroyed the infant; and if, therefore, the two existed in the relation of cause and effect, which however is far from certain, the prior event must have been the cause, the subsequent the effect.

But another important question here presents itself. Conceding that inflammatory affection within the cranium may be the cause, in some rare instances, of the crowing inspiration, is the effect direct? or is some intermediate agency required? and if the latter inquiry be answered in the affirmative, what, it may be asked, is the nature of that intermediate change? It has, I think, been satisfactorily ascertained that vascular turgescence, meningitis, inflammation of the cerebral texture, and enormous effusion within the cranium may take place without producing any functional derangement of the glottis; that the latter often occurs to a very violent and even fatal extent, without any other morbid appearances within the cranium, than those which arise from the “suffocative struggle;” and, lastly, that where death occurs suddenly, it is more allied

to strangling than pressure upon the brain. In the emphatic language of Mr. Robertson, "he appeared to die as if he had been strangled with a cord, only much more quickly."

Arguing from things known to things which are unknown, we shall have no great difficulty in detecting the coincident morbid affection, by the intermediate agency of which in those instances where the head affection precedes the crowing, the latter is produced. We have seen that enlargement of the cervical glands, from whatever cause arising, will produce the laryngismus stridulus, and we have the highest authority for asserting, that "these glands not only enlarge from particular affections of the teeth and jaws, and of the integuments on the outside of the head, but from affections of the brain and its coverings."⁵ By this is, of course, meant some inflammatory state; for I know of no instance in which glands are enlarged in consequence of mere vascular turgescence in parts at a distance; and the enlargement will be much more certainly produced, if this morbid affection partake of some constitutional taint, as scrofula. Now, the children who are liable to the crowing inspiration, it is well known, are particularly those, who either are born of scrofulous parents, or have manifested in themselves symptoms of the same constitutional disease; and Dr. Marsh has expressly stated, that he never saw the disease but under one or the other of these circumstances. It is highly probable, therefore, that such enlargement of the glands took place, and was the cause of the crowing inspiration in the case related by Dr. Davis; for the inflammation of the corpus striatum presented an appearance highly characteristic of scrofula; and it is clear, from a similar case of inflammation of the same part of the brain, (the corpus striatum,) recorded by Dr. Abercrombie, that inflammation of that part, though it go on to the formation of encysted abscess, is not, in itself, sufficient to produce this disease, or any peculiar affection of the glottis. My own observation confirms this suspicion; for, in the case of W. C., although the paralysis of the levatores oculorum was traced, upon dissection, to compression of the nerves which supply

⁵ Cruikshank, on the Absorbents, p. 131.

those muscles, the cause of the crowing was discovered in the enlargement of glands, surrounding and embarrassing the function of the recurrent nerves; and I may safely add, that in no case, within my own knowledge, of the combination of head affection with the crowing inspiration has the coincident enlargement of the glands been absent.

Since, therefore, inflammation, in all its varieties and in any part of the encephalon, constantly occurs without affecting the movements of the glottis; since enlargement of the cervical glands is apt to be produced by such disease within the cranium; since enlargement of the same chain of glands, from whatever cause arising, will produce the laryngeal affection, which increases with their growth, declines with their diminution, and ceases with their disappearance; since head affection, when there is coincident enlargement of these glands is apt to be accompanied with the crowing inspiration, which, however, does not take place until the glands are perceptible, sometimes months after the first attack of cerebral disease; since in considerably more than twenty successive instances of the crowing inspiration, within my own observation, the symptom has been associated with its supposed cause, either observed during life or seen after death; and since, as in several of Mr. Pretty's cases, the head affection may be cured, and yet the crowing remain for weeks or months, it is surely not irrational to infer, where the symptom is observed, that its cause is present also, although it may not be easy to detect it. Such a conclusion is in strict conformity with the laws of medical evidence. Having traced, by frequent observation, the occurrence of certain phenomena in association with certain structural changes, wherever afterwards the former present themselves, we infer the existence of the latter. It is in this way only that we judge of the occurrence of gastritis, enteritis, nephritis, pleuritis, and other ailments out of the reach of sight. We are satisfied with the evidence of external symptoms, and act accordingly. But in the disease under consideration, besides the ordinary proofs, derived from symptoms, of the existence and nature of the producing cause, there are others which commonly address

themselves to the senses of sight and touch. The visible and tangible qualities of these glands enable us generally to distinguish them; and I have little doubt that it is upon the enlargement of these glands that the combination, rare as it is, of the crowing inspiration with hydrocephalic effusion or excitement depends. It is this which explains the occurrence of the laryngeal affection in one case of cerebral disturbance, its absence in another; and where, therefore, the cerebral affection is prior and the crowing subsequent, it is probable that the primary disease within the cranium has produced a secondary disease,—enlargement of the cervical glands,—and that this secondary disease is the cause of the last in the series of events, namely, the peculiar affection of the glottis.

From all this it results, that vascular excitement of an inflammatory character within the cranium may occasionally produce the crowing inspiration; but the weight of testimony is decidedly adverse to the conclusion that such relation is frequent, or that it is direct. The pathological condition within the cranium may be the cause of the convulsions, and, in some instances, of the death of the child; but the breathlessness and crowing are the consequence of the enlargement of the glands.

Sometimes the relation between these two maladies is one merely of coincidence, in which case they may either be contemporaneous, or the one may indiscriminately succeed the other. The most unequivocal examples of this kind of association is where the bronchial glands, to the exclusion of those of the neck, are enlarged; for, whatsoever the effect disease within the head may produce upon the *glandulæ concatenatæ*, it can exercise no direct influence upon the glands at the root of the lungs. The co-existence of these two morbid conditions, distant from and unconnected with each other, has been noticed in the course of the dissections of that minute and elaborate anatomist, Mr. Swan. He has assured me, and has allowed me to mention the fact upon his authority, that in fatal cases of hydrocephalus, he has not unfrequently seen such enlargement of the bronchial glands: but whether in those instances the crowing inspiration occurred, he never

heard ; or if he did, he has forgotten, his attention not having been drawn specifically to the point.

In some of those cases, also, in which enlargement of the cervical glands co-exists with hydrocephalic excitement, it may be that their enlargement is not so much a symptom and consequence of vascular excitement within the cranium as the mere contemporaneous effect of a constitutional taint ; and when, as in some of Mr. Pretty's cases, the head affection is subdued, but the crowing remains for weeks or even months, and at length yields to change of air, tonics, and such remedies as have influence upon scrofulous ailments, we may, probably, in fairness conclude that such is the nature of the relation. It affords, also, confirmation of this, that in some instances, after the cure not only of the head affection but of the stridulous inspiration, "the child remains delicate, and suffering severely from scrofulous disease."³

Cumulative and corroborative evidence upon the same point may be derived from the affinity between hydrocephalic disease and a strumous constitution. This relation has been noticed by many,⁴ has been very strongly stated by Cheyne, and subjected to calculation by Perceval. The latter writer, "in reviewing some notes on hydrocephalus," found that "of twenty-two cases enumerated, eleven were known to be strumous, three were suspected to be such, and four were accompanied with an enlargement of the head, probably, from a ricketty constitution."⁵ Dr. Cheyne alleges that "it" (hydrocephalus) "chiefly falls upon the children of families having considerable strumous taint ; that, not only are children, in whom scrofula is active, very liable to hydrocephalus, but, conversely, that all the symptoms of hydrocephalus are sometimes exchanged for scrofulous disease ;" that "in many dissections, the surface of the liver has been studded with small white tubercles, not larger than grains of mustard ;" and lastly, that "the glands of the mesentery are often diseased, as is evinced by their enlargement, and the caseous deposits which exist in their substance."

³ Marsh, *Op. Cit.*

⁴ Ludwig, Sauvages.

⁵ *Medical Facts and Observations*, vol. i. p. 129.

⁶ *Essays on Hydrocephalus*, p. 11. Second edition.

These data are abundantly sufficient to justify the opinion that in cases of the combination of convulsions from head affection with the stridulous inspiration, there may have been simultaneous strumous disease of the cervical or bronchial absorbent glands, either of which in a state of enlargement, it has been already shown, are capable of producing this peculiar, and, under such circumstances, purely accessory and accidental laryngeal affection, which should then be considered as the symptom of the glandular, not of the cerebral, disease.

There is still another relation subsisting between the crowing inspiration and the cerebral congestion and disturbance, which I have had many opportunities of observing, and which I believe to be the form in which the association most commonly presents itself. The vascular fulness or excitement, in these cases, is the consequence of the frequent returns of the embarrassed state of the respiratory function.

Stoll is represented to have entertained an opinion that this "child-crowing" might result from impeded return of blood by the jugular veins; but, conceding all that Stoll has advanced upon the point, it is manifest that the interrupted return of blood from the head must have been the consequence of the distress in breathing, not its cause.⁷

This may generally be considered, with the exceptions already noticed, to be the nature of the connexion where the crowing inspiration has long preceded the convulsions or other symptoms of head affection; and it appears to me highly probable that such was the relation in the two instances related by Dr. Clarke; for in one, "universal convulsions had *succeeded to a long continuance* of the peculiar convulsive affection of the muscles of inspiration;"⁸ and in the other "the convulsions, of which the child died, *were preceded* by the peculiar spasmodic inspiration."⁹ Of the instances, also, related by Mr. Pretty, in the first, it was not till after the child had been affected *for several weeks*, that it was for the first time attacked with two slight convulsions, followed by "a third in the afternoon of the same day which

⁷ London Medical Repository, vol. xiii. p. 415.

⁸ Commentaries, p. 94.

⁹ Ibid. p. 96.

terminated her existence almost immediately." The third case, also, mentioned in the same communication, is decisive upon the same point. "For some time previous to his illness he could never bear that active exercise in the arms, which a good nurse will always give a healthy child, without the respiration and circulation becoming so seriously impeded, as to give alarm for his safety to all present." Slight feverishness accompanied the commencement of the disease, which was relieved by leeches, aperients, and salines; but the crowing continued. A few weeks after this illness he had a convulsion, which was relieved by the same means. He was permanently cured by sending him into the country. In this case, as in the former, the affection of the glottis was established for some time before febrile symptoms appeared, and very long before the attack of convulsions which marked the secondary influence of obstructed respiration upon the cerebral circulation. The course of events, in these cases, amply confirms the observations of Dr. Marsh, that "it is more than doubtful whether in this affection, at its commencement, the brain be at all involved;" "that it is only when the disease increases in severity, and when general convulsions arise, that the brain or its membranes become the seat of disease;" and that the appearances upon dissection in one instance, "the turgid state of the vessels of the brain and lungs, as well as the gorged state of the heart, were evidently effects of the suffocative struggle."¹ The opinions of Golis, also, much coincide with this view of the subject; for, amongst the predisposing causes which "excite irritation, by which an increased congestion towards the head is produced, which irritation becomes an exciting cause, certainly not the rarest, of the acute hydrocephalus," he enumerates, together with "chin-cough," and several other maladies, "a peculiar disorder of respiration, in which infants, after sudden waking out of sleep, after terror or anger, often, too, without any cause, are suddenly seized with a deep shrill respiration for many seconds, sometimes even for minutes, threatening suffocation."²

¹ Dublin Hospital Reports, vol. v. p. 616.

² Golis, translated by Dr. Gooch, p. 71.

The first effects upon the vessels of the head of the reiterated "suffocative struggles," in this disease, commonly manifest themselves in the veins. During the fit, the jugulars are turgid, and the veins upon the forehead, temples, and side of the head strongly pencilled and almost black. This turgid state of the smaller veins of the surface often continues for a considerable time after each attack; and that, which is going on in the veins returning blood from the outside of the head, in all probability obtains in the interior also. Dissection has amply proved that it is so; for, in fatal cases, the sinuses have been commonly found gorged with blood of a very dark colour, and the veins leading towards them proportionally distended. The appearances have been precisely those which have been observed in cases of suffocation from any other cause, as in instances of death from either drowning or hanging, in the former of which, "upon dissection, we shall perceive the vessels of the brain more or less gorged with blood;"³ whilst, in the latter, "we not only find vascular congestion, but even sometimes sanguineous effusion. *The fingers are usually bent, the nails blue, and the hands nearly closed.*"⁴

This venous congestion is sometimes the only observable change in the vascular system; but where these have been the only changes, I have never known general convulsions. The child may have had, what in the language of the nursery may be called, a fit; but that fit has been more allied to breathlessness than convulsion, although, as in strangling, the face may be dark-coloured, the eyes staring, the muscles of the face convulsed, the back bent backwards, the hands clenched, and the limbs as "rigid as a log of wood."

When this venous congestion has occurred for some time, it is very apt to be followed by serous exudation, just as a tumour or other compressing cause, obstructing the circulation in the veins of the extremities, will cause edematous effusion. In this state, if my experience deceive me not, the child will generally be found drowsy, heavy, and torpid in its faculties,

³ Paris and Fonblanc, on Medical Jurisprudence, vol. ii. p. 38.

⁴ Ibid. p. 45.

the pupil much dilated and sluggish, the action of the flexors preponderating over the extensors and producing the carpo-pedal contractions; the urine also commonly scanty, and the bowels confined. But even in these cases of effusion from impeded venous circulation general convulsions are very rare, although it is a condition which certainly threatens that formidable malady by its tendency to produce the next in the series of events—actual inflammation.

It is scarcely necessary to enter into any lengthened argument to prove that, in a part in which there has been venous obstruction of considerable duration and extent, arterial excitement is often a remote consequence. This pathological principle may be proved and illustrated by the simple experiment of tying the finger, the first effects of which are swelling, tension, and redness of a dusky or blueish tint, beyond the part where the ligature is applied. The consequence of this is speedily manifested in the arterial system of the part by the heat, pain, and throbbing which succeed; and, if this state continue, inflammation may ensue. It is the same with the cerebral circulation. Venous obstruction, long continued, produces arterial congestion and excitement; these may end in inflammation, and this, especially if it extend to the medullary substance or serous linings, is almost invariably attended by general convulsions, and followed by serous effusion within the cavities; and these are not unfrequently, in such cases, the cause of the fatal termination. This appeared to me to be the nature of the connexion in a very interesting case of the combination of these two maladies, which occurred within my observation at Chelsea. The child of a wine merchant had been subject for many months to the crowing inspiration, which was at length succeeded, towards its fatal termination, by violent general convulsions. The veins upon the surface of the head were distinctly marked and evidently gorged, the jugulars during the attacks immensely distended, the vessels of the conjunctive loaded, and the fontanelle elevated. Active remedies were had recourse to, as affording the only chance, but without avail, the child dying within eight-and-forty hours from the period of my first seeing it. I was unfortunately

unable to obtain permission to inspect the body ; but there was no doubt, in the mind either of the general practitioner or myself, of the existence of, at least, vascular excitement within the cranium.

This form of connexion between obstructed respiration from diseased glands and hydrocephalus is beautifully illustrated by an observation of Cruveilhier, already quoted for another purpose, of the occurrence of secondary acute hydrocephalus in consequence of pulmonary phthisis accompanied with enormous tumefaction and cheese-like suppuration of the absorbent glands of the thorax and abdomen, and in which he represents the state of respiration as one in which the brain appeared little sensible of the necessity of breathing, or in which the nervous energy was less freely transmitted to the inspiratory muscles :—the difficulty being, therefore, in inspiration, not in expiration, and proving that the recurrent, possibly also the par vagum partially, had been subjected to the pressure of these glands ; for it could be only by blunting the sensibility of these nerves that the sensation of distress in breathing could well have been prevented.

Such, then, as far as my opportunities have enabled me to judge, are the relations which the crowing inspiration of infants and a morbid condition within the cranium bear to each other. The head affection may be prior, and produce, by remote and indirect consequence, the laryngeal complaint ; they may occur together, as mere coincidences, without any other association than the existence of a constitutional malady, which may be the common cause of both ; the cerebral disturbance, again, may be the consequence of the frequent attacks of breathlessness, almost amounting to asphyxia, which, by impeding the flow of blood through the lungs, causes accumulation within the cavities of the heart, and, subsequently, venous congestion within the cranium ; and this may be followed by effusion of serum into the ventricles or between the membranes of the brain, and, occasionally and remotely, by inflammation and its ordinary consequences.

The causes, which I have hitherto enumerated, act exclusively upon those glands which are interposed between the

organs affected and the venous circulation to which their absorbent vessels are proceeding, and, by consequence, principally upon the deep-seated cervical glands; though from thence the disposition to morbid enlargement may extend, by continuity or contiguity, to the bronchial glands, which constitute the extremity of the chain. I am next to consider those which influence primarily the bronchial glands, although the cervical may also be simultaneously affected, either by extension of disease, or from the influence of the same constitutional taint.

Bronchitis — Upon some occasions, I have had reason strongly to suspect that simple bronchitis has, by contiguous irritation, caused enlargement of the bronchial glands, and thus rendered the original disease more intractable, and occasioned the crowing inspiration. An instance, in which I am inclined to believe that this was the nature of the connexion, was early in the present year under my care. A whole family residing at Bayswater, including an infant about twelve months old, had been affected with catarrh, accompanied with severe coughs, when I was desired to see this youngest child on account of a croupy inspiration, without such cough as in the slightest degree resembled either croup or whooping-cough. This crouping noise was often brought on by the catarrhal cough; but it would also occur without being either preceded, or accompanied, or followed by cough. I had seen the child four or five times before I had an opportunity of witnessing one of these attacks, when, upon Jan. 22nd, it was seized during my visit. It first struggled for its breath, extended its limbs rigidly, and bent its spine forcibly backwards. At the end of a few seconds, however, it recovered its breath with a shrill, sonorous inspiration, which recurred frequently, until, at length, the breathing again became comparatively regular. The whole attack, which throughout was without cough, probably lasted about five or six minutes. Leeches, the warm bath, salines with antimonials, active aperients, and an abstemious regimen relieved the child; but, after witnessing the seizure upon the 22nd, I ordered also a small blister to the upper part of the sternum. In some positions of the neck,

I thought that I could perceive the irregularity, which marks enlargement of the glands, beneath the deep-seated fascia of the neck ; but I am rather of opinion, in this case, that the bronchial glands were principally implicated. My opinion upon this point is much influenced by the facts that the complaint began as bronchitis ; that, until the application of the leeches to the upper part of the sternum, it was accompanied with fever ; that the remedies greatly subdued and almost removed the cough as well as the fever ; but that, still, the crowing remained, because the glands, enlarged by the contiguous inflammation, remained indolent and indurated in a strumous habit, of which one at least of the parents partakes with the other children, several of whom have had considerable enlargement of the cervical glands.

This cause is, probably, more common than is generally imagined ; and hence the frequency with which this disease has received the denomination of “catarrhe,” to which the adjuncts “suffocant” and “nerveux,” have been applied to characterise the severity and the peculiarity of its symptoms. It is scarcely needful to dwell upon the probability or nature of this connexion between inflammation of the bronchi and enlargement of the glands through which the absorbents, from this part of the air-tubes, pass. If mercurial irritation within the mouth can occasion enlargement of a gland under the jaw : if chafing the nates, or even the foot, can enlarge an inguinal gland ; if, amongst the most common causes of enlarged glandulæ concatenatæ are an excited or inflamed state of the gums, or of the surface or the interior of the head, then, it is easy to understand that inflammation of the bronchi, especially in individuals prone to glandular disease, may occasion a tumid state of the bronchial glands.

Disease of the Lungs.—In one case, which fell within my observation and which I had an opportunity of examining after death, the exciting cause of the disease was, probably, very extensive disease of the lungs. From the symptoms, especially the “râle” without expectoration and the crowing inspiration, I had anticipated that I should find the bronchial glands enlarged : dissection proved that they were very greatly so. This

child had had the whooping-cough twelve months before, and had only recently again begun to hoop. As, however, he had not been well during the whole period, it is probable that the lung disease had been long going on, and that, when the hoop or croupy inspiration recurred, the bronchial glands had become implicated in the manifestly scrofulous disease of the lungs themselves.

Inflammation of the Pericardium.—The only other cause I shall notice, I mention upon the authority of a single instance recorded by Dr. Clarke;⁸ namely, suppurative inflammation of the pericardium. There was no proof that, in the commencement of this disease, the head was affected; it was believed to have become implicated in its progress, though even this was not ascertained by dissection; and, at all events, there is no proof that the sonorous inspiration was the consequence of the loaded state of vessels within the cranium. A solution, much more consistent with probability, presents itself in the supposition, that the bronchial glands had become secondarily affected. The appearance within the pericardium was conclusive, in my estimation, as to the scrofulous character of the inflammation, and this could scarcely fail of contaminating the glands in the course of the absorbent vessels leading from the diseased surface. The glands which receive the absorbents of the heart “are not situated upon the heart, *but behind the middle of the arch of the aorta,*” “*and at the root of the trachea.*” At this place the glands belonging to the heart and to the lungs are in some measure blended together, and the trunks arising out of them do not belong wholly to the heart, but also to the absorbents of some parts of the lungs.”⁹ It is thus rendered probable, that glands, which we know to be, in their enlarged state, capable of producing the stridulous inspiration, were in reality affected, and, at all events, it is as rational to suppose this, as that the head, which does not appear to have been examined, should have been the seat of the original affection. That cerebral disturbance may have been the cause of the convulsions and of the death, is abundantly possible; but the case affords no coun-

⁸ Comment. p. 96.

⁹ Cruikshank, p. 174.

tenance to the opinion, that the crowing was owing to the same cause.

This opinion derives material confirmation from the cases of suppuration of the pericardium, to be found in the works of Lieutaud and others. The former writer has collected no less than sixteen instances in connexion with the symptoms which they manifested, besides several others to which he refers and which amount to nine;¹ but although he was well aware of the existence of such disease as the catarrhus suffocans, which he has described in another of his works,² and describes one of its forms as arising from “a spasmodic affection of the glottis,”³ yet he has never once noticed this diseased condition of the pericardium, as even remotely connected with such symptoms, as characterise that condition of the entrance to the windpipe, in any single instance amongst the “hoc historiarum agmen” which he has recorded, and to which ought, according to his account, to be referred other instances, related under different heads, in other parts of his works.

SECTION III.—CAUSES OF THE PAROXYSM.

SUCH are the causes which appear capable of producing the disease itself, or that pathological condition upon which the phenomena depend. But the symptoms are not constant; they recur at varied intervals, the intermissions being complete; and the various other causes, which authors have enumerated amongst the occasional causes, are just such as excite the paroxysms. In considering these, I shall first notice those which are enumerated by other writers, and principally in the order in which they have noticed them, that it may not be imputed to me that I have allowed my observations to be warped by any preconception, which might be suspected to originate in the peculiarity of my views with respect to this malady.

The causes mentioned by Dr. Clarke, are strainings of the

¹ Hist. Anat. Medic. vol. i. p. 67.

² Synopsis Universæ Praxeos Medicæ, vol. i. p. 166.

³ Ab spasmodica Glottidis Constrictioni.

body, exercise, fretting, a full meal, and sudden awaking from sleep, and it is at once interesting and useful to inquire how each of these causes operates in exciting an attack of the disease.

Strainings of the Body — All violent strainings of the body imply the filling of the chest, the subsequent closing of the glottis, and a short suspension of the respiratory function. This has been beautifully illustrated by Sir Charles Bell in his very interesting paper upon the human voice. “A sailor,” says this ingenious writer, “leaning his breast over a yard-arm, and exerting every muscle on the rigging, gives a direction to the whole muscular system, and applies the muscles of respiration to the motions of the trunk and arms, through the influence of a small muscle that is not capable of raising a thousandth part of the weight of his body. He raises himself by the powerful combination of the muscles of the abdomen, chest and arms; but these muscles are controlled and directed by the action of a muscle which does not weigh five grains. The explanation is this; a man preparing for exertion, draws his breath and expands his chest. But how is this dilatation to be maintained? If the muscles which expand the chest are to continue in exertion, to preserve it so, there must be a great expenditure of vital force; besides, these muscles are now wanted for another office. The small muscle that closes the chink of the glottis suffices. It contracts on the extremity of the windpipe, and here, acting so as to confine the column of air, it is superior to the united power of all the muscles of the chest and trunk of the body which act upon the cavity of the thorax. However powerful the muscles of expiration may be in compressing the chest, their influence is very small on the column of air in the windpipe, the pressure there being no more than on every part of the walls of the chest, which is of the same diameter as the base of the tube. The closing of the glottis by this small muscle, throws all those of the chest and abdomen, which are otherwise muscles of respiration, free to act as muscles of the trunk and arms.” “Thus we perceive, that the muscle of the glottis, not weighing the thousandth part of the muscles of the trunk, and of the body, controls them all,

changing them from muscles of respiration to muscles of volition ; and this it is enabled to do on the principle of the hydraulic press.”⁴

Some apology may perhaps be due for the length of this quotation . it will be found in the clearness and perspicuity of the whole statement, which it would be impossible to “curtail of its fair proportions,” without injustice, and the risk of producing some obscurity. It affords incontestible evidence that, in cases of violent exertion of any kind, the respiration is suspended, and the glottis is closed. It is exemplified in the sailor ; but equally so in the strainings of a labour, during which the patient “holds in her breath and bears down ;” and in those of constipation. So, if the child strains considerably, whether to get rid of flatus or feculent matter, or to be released from a constrained position which is disagreeable to its feelings, or as a simple expression of mental annoyance or physical suffering, by natural associated movement the glottis is closed. The effect is indeed involuntary, sometimes vehement, but it cannot be said to be anormal ; and there is no proof that it is convulsive. It occurs in all cases of violent straining, but no paroxysm of this disease takes place ; the glottis, naturally closed during the effort, opens again for the purpose of respiration ; where, therefore, it does not again open, it would be much more natural to infer, that there is some defect in the opening, than any convulsive movement of the closing muscles, for it closes naturally when it is required for straining ; there must be, therefore, some defect in the forces by which it is reopened.

Exercise—To exercise, as a cause of an attack of this disease, the foregoing observations will also to a certain extent apply. That this may operate in producing a paroxysm is highly probable, and much confirms the statement of Dr. Millar, that “children at play were sometimes seized.” By exercise, however, can scarcely here be meant the ordinary movements of a child, but some greater exertion than usual ; and this, amounting to straining, may be referred to the same head with that cause ; in the same way, by natural associated movement, it closes the

⁴ Phil. Trans. 1832, p. 309.

glottis, and, therefore, admits the same explanation. But strong exercise, short of violent straining, may occasion a paroxysm of this disease by disturbing considerably the respiratory function. The embarrassment of respiration, thus produced by strong exercise, was understood by the ancients, and is alluded to by Aretæus, Galen, and Ægineta, as a familiar illustration of the kind of distress which exists in asthma. In such a distressed state of the respiratory apparatus all the muscles are more vigorously exerted—some, whose movements were not before observable, becoming marked and violent. The sphere of action of all is increased, and amongst the rest, the muscles of the glottis partake of the influence; and if, under such circumstances, any thing can disturb the balance of power between the antagonist muscles, the glottis may remain more than usually closed, either from too vigorous action of the closing, or enfeebled energy of the opening muscles. In the absence of other evidence upon the point, it would be quite as likely that the latter, as that the former, should obtain; and as in strainings of the body it appears demonstrable, that it is a natural exertion of natural agents that closes the glottis, and that it remains closed because the power to overcome this contraction is not exerted; so, it can scarcely be considered as too great a stretch of analogical reasoning to infer, where a partial or total suspension of the breathing, attended or followed by the stridulous inspiration, takes place from exercise more violent than usual, that this occurs from some unusual defect in the powers that should reopen a chink, which is closed by the ordinary exertion of ordinary agents.

Fretting.—By fretting, I take it for granted, must be meant the act of crying; and that violent weeping, especially if combined with sobbing, may produce an attack of this complaint, I have had repeated opportunities of seeing. Again and again I have observed it from lancing the gums for its cure, and sometimes, the child being old enough to recollect persons and events, the fit has even returned upon my coming into the room, having upon former occasions freely lanced its gums,

That such weeping greatly disturbs the respiratory function scarcely requires proof or illustration; but if very vio-

lent, it may even completely put a stop to the respiration altogether, conformably with an observation from a work perhaps better known and appreciated by artists than by the profession, that "in a child we see the passion sometimes so violent, that the breathing is quite suspended and the face becomes black;"⁵ or, to use a common expression, which proves that unprofessional persons are familiar with the fact, "the child cries till it is black in the face." That the breathing is embarrassed during a fit of crying, will scarcely be disputed, and it is equally matter of notoriety, that, if it be attended with sobbing, the glottis will be closed from time to time; for sobbing consists in reiterated short inspirations, intercepted by forcible and involuntary closing of that chink. In the former case, in which the breathing is merely embarrassed, the circumstances are similar to those already noticed, when considering exertion as the cause of a paroxysm,—the closing of the chink is probably not complete; in the latter case, the closing is complete, involuntary, and, it is said, convulsive, for we often hear of convulsive sobs; but such closing of the glottis can hardly be in fairness called a morbid condition, since it occurs in every instance of sobbing. When the sobbing ceases, the glottis again becomes permanently open, and the regularity of breathing is restored; but if any cause exist which can enfeeble the opening muscles of that chink, it may be so far obstructed as to occasion an attack of crowing; and if these be still further weakened, still more certainly if paralysed, the glottis will remain closed for a while, then open partially, and there will be in the first instance breathlessness amounting to temporary asphyxia, followed by the crowing inspiration. It thus appears to be in a want of power to open the glottis sufficiently for the purposes of respiration, that the diseased action in this malady consists; and strong confirmatory evidence of this may be derived from the statement of Millar, that "if the child was not speedily relieved by coughing, belching, sneezing, vomiting, or purging, the suffocation increased, and he died in the paroxysm."⁶ If the glottis in these cases had been closed by the excessive and anormal

⁵ Sir Charles Bell's *Anatomy of Expression in Painting*, p. 132.

⁶ On the *Acute Asthma of Children*, p. 18.

action of the closing muscles, the larynx, hermetically sealed, would have been equally impervious to the passage of air in either direction ; but whilst the efforts to inspire are ineffectual, a comparatively slight explosive expiration removes the obstruction ; just as, in the experiments of Le Gallois when he paralysed the opening muscles but left those which close the glottis free, although a syringe, introduced into the trachea, would force air with the greatest facility upwards through the glottis, yet when he attempted to draw it in the opposite direction from the mouth downwards, the same resistance was offered as would occur from stopping the extremity of the syringe with a finger.

Cough.—Cough is commonly rather a symptom or consequence of the pathological condition upon which this disease depends, than the cause of the paroxysm. Occasionally, however, the latter relation may be observed ; and its influence in thus occasioning a paroxysm may be referred, like weeping, to the disturbance it occasions in the respiratory function, by which the sphere of movement of the rima glottidis, both in opening and closing, is enlarged. But there is another mode in which violent cough may operate. If this very peculiar disease in a large proportion of cases depend upon enlargement of the cervical glands under the deep-seated fascia of the neck, it is probably by their pressure upon some important texture or organ, that the effect is produced ; and, if so, it might be anticipated, that whatever added to that pressure would occasion a paroxysm or aggravate the malady. In cough, it is well known that the muscles of the neck are in vigorous and even violent action, and cannot fail, under such circumstances, to compress these glands ; and it is the more probable, that the fit produced, under such circumstances, is owing to the additional compression of the enlarged glands by the action of these muscles, that a paroxysm has been occasionally produced by a sudden twisting of the neck, which throws the sterno-cleido muscles into vigorous contraction, and even sometimes by mechanical pressure. Of the effect of extraneous pressure in producing an attack, I met with a very striking illustration in the spring of the last year. I was desired to see a child in Hemus-terrace, Chelsea, in whom general con-

vulsions had succeeded to a very long continuance of this disease in its most aggravated form. My fears in this case greatly preponderated over my hopes in consequence of the extreme frequency, severity, and duration of the attacks of suspended breathing terminated by crowing, and of the general convulsions which seemed to indicate disease within the cranium. The face was pallid or, rather, lurid, and the veins upon the forehead and temples were strongly marked with black blood; the skin was cool, but the vessels of the conjunctive somewhat loaded, and the fontanelle slightly prominent. As affording the only chance of recovery in this disturbed state of the cerebral circulation, I suggested, even at this late period of the disease, leeches and frequent doses of calomel; but the exhaustion from four leeches was formidable and almost irrecoverable. I was assured, upon first seeing this patient, that the glands were not particularly enlarged, but on examination, I found a continuous chain from the jaw to the sternum. They were large, hard, and irregular, and when I pressed with my finger and thumb upon some of these, nearly upon a level with the cricoid cartilage, a fit of asphyxia was produced, which, from its duration and violence, I feared might be fatal. At length, however, after putting the child into warm water, which had been kept constantly ready on account of the frequency of the paroxysms, dashing its face with cold water, applying ammonia to its nostrils, rubbing forcibly the spine and ribs, and endeavouring to provoke vomiting by irritation of the pharynx with a finger, it recovered with the lengthened and redoubled shrill sonorous inspiration so characteristic of this disease.

Abdominal Distention.—These attacks, according to Dr. Clarke and others, “commonly take place after a full meal.” This cause obviously resolves itself into simple distention of the stomach and upper part of the alimentary canal, and it can matter little whether this distention is produced by “coagulated milk,” to which Primerosius, Etmuller, and Hoffman, referred the occurrence of the asthma of infants, or by “thick panada,” as in the case related by Dr. Henry Davies, or by “stir-about,” as in one of the instances recorded by Dr. Marsh. Those

who believe with Dr. Clarke, that this complaint depends upon vascular turgescence and excitement within the cranium, would probably refer the attack, under such circumstances, to an increased determination of blood to the head, the compound result of arterial excitement from a full meal, and of "the tendency to prevent the free circulation through the lower extremities," (implying an increased flow upwards,) which compression of the descending aorta by a distended stomach might possibly occasion. But this opinion is irreconcilable with the appearances; for the dark meandering veins upon the forehead and temples, the lurid tinge of the lips and countenance, and the enormous distention of the jugulars show that the congestion, where it exists, is, at least at the commencement, rather venous than arterial, and much more frequently results from the fits, than produces them.

Any other cause of distention acting upon the alimentary canal or within the cavity of the abdomen, may also occasion a paroxysm. So wind pent up within the bowels of an infant is commonly attended with a dark colour under the eyes and around the mouth, showing a slight interruption to the venous circulation; and, when combined with some other symptoms, especially a little rolling of the eyes and "the infant's mouth being drawn into a smile,"⁷ such appearances have been denominated "inward fits." Should the evil effects of this go further, hiccough, consisting in a succession of short jerking inspirations suddenly interrupted by a momentary and involuntary closing of the glottis, is very apt to occur, and is frequently long continued and severe; if still further, it may occasion great distress in breathing from the interruption to the due descent of the diaphragm; and, lastly, should there be a tendency to this complaint, established by any of those causes to which I have already adverted, then, if the glottis remain completely closed, there will be temporary, even sometimes fatal, asphyxia without crowing; or, if the chink be slightly and imperfectly opened, then, there being only a small aperture for the admission of a slender current of air, the crowing inspiration will occur. The connexion of abdominal distention with this

⁷ Underwood

complaint did not escape the observation of Millar, who states that "the body was generally costive," and "the stomach and bowels often very much inflated;"⁸ and hence we may satisfactorily explain the advantage alleged, by Dr. Meriman and others, to be derived from soda and aperients, as well as the beneficial effects ascribed by Millar, Underwood and a host of authorities, both British and continental, to assafœtida, hartshorn, oil of amber, soot-drops, and other agents, which are amongst the most efficient remedies for the expulsion of flatus from the alimentary canal.

Intimately allied to the last-mentioned cause, is one much insisted on by Primerosius, and adopted from him by Et-muller and others, namely, disordered secretions and other acrid contents of the stomach, on which account it is that those writers recommend either artificial sickness to be induced, or spontaneous vomiting to be encouraged. But this state of the stomach implies indigestion, and one of the most common attendants upon this is flatulent distention, into which, probably after all, the cause resolves itself, acting by mechanical impediment to the respiratory function.

This account of the influence of abdominal distention upon the paroxysm of this disease, involves three distinct propositions, each of which deserves a brief consideration. It is alleged, 1st, that abdominal distention really exists in this disease; 2ndly, that such distention will embarrass considerably the respiratory function; and, 3rdly, that it is this disturbance of respiration which determines the occurrence of the attacks.

1st. That distention of the stomach and upper part of the alimentary canal is a common attendant upon this disease, I have already stated upon the authority of Millar, is abundantly corroborated by my own observation and experience, and is illustrated by some of the cases I have related. This is commonly the result of injudicious feeding, nurses being prone to err upon this point both as to quantity and quality.

But in feeble children, although there may be no indiscre-

⁸ On the Asthma, p. 19.

tion in diet, yet the same distention is apt to occur in them, because their digestive organs, partaking of the general weakness, have their function impaired. Ordinary food, therefore, remaining undigested, will ferment; the stomach, capable of little resistance to the accumulated flatus, becomes distended; and this occurs the more readily, because, in such children, all the muscular textures being flabby and losing much of their contractile power, that organ has lost the support which the abdominal muscles should give it.

Similar in its influence is enlargement of the mesenteric glands. Dr. Clarke, indeed, believed that these acted mechanically, by compressing the aorta, impeding the flow of blood downwards, and thus causing, indirectly, vascular congestion within the cranium. The same doubts of the accuracy of a similar explanation, applied to the influence of distended stomach in occasioning a paroxysm of this disease, apply also to the effect of these glands. It is at first venous, not arterial, congestion. But the obstructed glands in these cases are almost always attended with intestinal inflation, and this inflation it is, not the large glands, that produces the fit, in the same way as the latter is produced by distended stomach.

2nd. That abdominal distention may interfere with the action of the respiratory organs, is abundantly susceptible of proof; nor is it less manifest, that its influence is principally that of mechanical impediment to the descent of the diaphragm. This effect is sometimes only temporary, a familiar example of which will be often seen in the effects of a tavern dinner, where the individual has partaken, even without excess, of dishes not the most wholesome, and of wine not of the purest character. Sometimes the breathing is simply oppressed from this cause, but upon other occasions the diaphragm, impatient of the restraint upon its movements, acts convulsively and produces hiccough, which consists in a rapid inspiratory movement, checked suddenly by a closing of the glottis; and these spasmodic succussions of the diaphragm often leave considerable soreness in the region of that muscle, and of the distended stomach itself. Upon other oc-

casions the embarrassment from distention is more permanent and distressing, which the following cases are calculated to prove and illustrate.

A tailor residing in Hereford-street, Lisson-grove, otherwise in health, and never having before or since manifested a single symptom of structural disease within the chest, sent for me on account of obstinate obstruction of the bowels, over which ordinary aperients had exercised no beneficial influence. Upon my arrival, I found this patient of large stature and robust health, with his waistband and waistcoat unbuttoned, and secured by long strings that there might be room for the enormous distention of his abdomen which was like a tun, and that his chest might be relieved from all pressure. He was unable to lie, on account of breathlessness, in the horizontal posture; his breathing, even when upright, was short and very laborious; he could articulate but few words at a time, and those in an enfeebled tone; his lips were swollen and blue, his countenance turgid and lurid, his eyes staring, his pulse irregular, his surface cold and clammy, and what sleep he got in the erect posture was interrupted by starts and frightful dreams. In fact, his appearance was that of a man dying of hydrothorax. Each additional dose of purgatives, which his stomach retained, only aggravated his distress by adding to his bulk; nor were stimulant glysters, administered by a very anxious and judicious general practitioner, more effectual. He was now directed to take two drops of croton oil, which purged him furiously in the course of the night, and, although enfeebled by the combined effect of the disease and its remedies, he could not resist the temptation of walking on the following day to my residence, a distance of nearly two miles, to express his gratitude for the relief he had experienced.

A woman above thirty years of age was supposed to labour under ovarian dropsy, and I was requested by the attendant practitioner to see her, that I might satisfy the friends as to the nature of the malady and the necessity for tapping. Upon inquiry, it turned out that, five months previously, she had miscarried, that she speedily recovered, that no tumour of the

belly was then perceptible, and that she shortly again became pregnant;—at least she thought so. When she supposed herself about three months advanced in pregnancy, (about six weeks previously to my seeing her,) she was free from swelling; then, carrying a pail of water up stairs she fell, and thought that she must have struck her stomach against the edge of a stair. Soon after this accident she began to enlarge, and had now increased to an enormous size. She was unable to lie down for fear of being choked, and had spent nights in her arm-chair; her lips and countenance were turgid and blueish, her eyes staring, her breathing fearfully laborious, her pulse irregular, her sleep short, imperfect, and interrupted by frightful dreams, and her urine scanty. Convinced of her pregnancy I examined, without success, the abdomen to ascertain, if possible, where the uterine tumour ended, and where the dropsical tumour, if it existed at all, began. I then examined per vaginam, and found the lower segment of the uterus like that of the full term of gestation; it was a smooth, thin, elliptical surface, without any prominent cervix. Unprepared with the means of puncturing the membranes, which I recommended before I could sanction the operation of tapping, I suggested some simple remedies for the night, but, upon my arrival on the following day, I found my patient cured. In the course of the night, nature had taken alarm, uterine pains had occurred, the membranes had burst, giving issue to torrents of liquor amnii, which escaped over the floor, and down the staircase, and twin children of about four months' growth finished, by their expulsion, the cure.

These were pure and unmixed cases of urgent dyspnœa from abdominal distention, and cured by the removal of the latter, the chest being free from disease.

3. This embarrassment of the respiratory function enlarges the sphere of movement of the glottis. The extent to which the glottis opens and shuts in ordinary and easy respiration cannot be made the subject of experiment or observation, the very means employed occasioning great distress in breathing. It is with the glottis, probably, as it is with the

nostrils, the movement of which in easy, quiet respiration is scarcely perceptible; but in an excited or embarrassed state of the respiratory apparatus, they spread wide at each inspiration. A similar state of the glottis is seen where the larynx has been separated from the os hyoides for the purpose of observing the movements of the rima glottidis, or of tracing the effect of dividing the pneumogastric or recurrent nerves, as in the experiment of Le Gallois, and as in the cut throat of the suicide observed by Sir Charles Bell, Mr. Mayo, and others. The chink then opens and shuts widely in the alternate actions of respiration. If in this more extended movement any cause should enfeeble or paralyse the opening muscles, it must be obvious that the sides of the chink remaining in closer approximation than usual, in the adult the breathing would be distressed, in children the crowing inspiration would be apt to occur; and this is proved by the fact, that any cause which can interfere much with the action of the respiratory organs, is very apt to occasion a paroxysm of this disease. Of this, the effect of crying is a striking proof. In the case of the child at Bayswater, the mother was congratulating herself upon the absence, for above twenty-four hours, of the fits of breathlessness and crowing, when a violent attack was produced by the screams occasioned by my attempt to look at its gums; thus realizing the statement of Burns, that "it is apt to come on from crying, or from awaking suddenly, or from any cause which hurries or at all affects respiration."⁵

Sudden awakening from sleep.—It is further alleged, that these attacks "often occur immediately upon awaking from sleep, though before the time of waking the child has been lying in a most tranquil state."⁶ This statement leaves it doubtful whether Dr. Clarke believed the act of awakening the child to be the exciting cause of the paroxysm, or that the concurrence of the two events was accidental. Another eloquent writer, however, upon this disease, not only considers the violent mode too frequently adopted by nurses in awakening the child to be really the direct cause, but has founded upon that belief the practical precept, "that every child, who

⁵ Popular Directions, p. 234.

⁶ Millar, Clarke, Hamilton, North.

has suffered from this malady, should be roused from its sleep with gentleness and caution." With Dr. Willich I agree, that "to awaken children from their sleep with a noise or in an impetuous manner, is extremely injudicious or hurtful,"⁷ and with Mr. North, that an attack may "return with all its original severity, in consequence of the child being wakened either by accidental noise or the imprudence of the nurse;"⁸ yet I believe that the relation between the two occurrences has been generally different from that which is here represented. In the majority of instances it will, I think, appear, that the child awakes because the attack has commenced, and is not attacked merely because it awakes, or from any violence in the mode of awakening. The observations, therefore, of Dr. Millar upon this point approach more nearly to the truth. According to his account, "a child, who went to bed in perfect health, waked an hour or two afterwards in a fright, with its face much flushed, or sometimes of a livid colour, incapable of describing what he felt, breathing with much labour, the returns of inspiration and expiration quickly succeeding each other in that particular sonorous manner, which is often observed in hysteric paroxysms."⁹ Here, the paroxysm seems to have occasioned the waking, not the waking the paroxysm; and the same view is taken of it by Capuron, who says distinctly, that the child is awakened by the attack.¹ In those comparatively rare instances in which the sudden waking of the child is the cause, its influence must be that of fright, into which it resolves itself, and the effect of which I am next to notice; where on the contrary, as generally happens, the attack awakens the child, the

⁷ Introductory Lectures to Struve's "Familiar View of the Domestic Education of Children," &c. p. 109.

⁸ On the Convulsions of Infants, p. 97.

⁹ On the Asthma, &c. p. 18.

¹ Elle (l'attaque) est presque toujours inopinée, subite, et nocturne. A peine l'enfant a-t-il goûté quelques heures de sommeil, qu'il est tout à coup réveillé par une anxiété des plus violentes; il se plaint d'oppression, comme s'il était près de suffoquer ou bien d'une espèce de serrement, comme si la poitrine était sous une presse ou fortement garrottée.—Des Maladies des Enfants, p. 439.

explanation must be sought in the effect of some of those other causes which I have noticed; 'but, still more frequently, in that of the accumulation of mucus in the bronchi and trachea, which is so frequent an occurrence in this disease, as to be one of its characteristics, occasioning that "prodigious rattling" observed by Molloy;—"that kind of noise which an increased secretion of mucus in the air passages would produce," noticed by Mr. North. The cause of this accumulation, especially during the night when it is most distinguishable and has often been observed by parents to be the precursor of the fit, I shall explain hereafter, together with its mode of action in occasioning the paroxysm.

Fright.—Analogous in its influence to the last-mentioned cause, where that does produce paroxysm, is the only additional exciting cause mentioned by Capuron, "fright." This, however, is often rather a part or consequence of the attack than its cause, though "the child's terror sometimes augments the disorder," and if violent, I doubt not may produce an attack. We know how great is the influence of terror in suspending the respiratory function when the mind is no longer under the dominion of reason, as in the case of frightful dreams, especially those attended with the night-mare, with which Gardien has altogether confounded this laryngeal affection; and although it may be that these dreams are suggested by some pre-existing embarrassment of respiration, yet there can be no doubt that they also indirectly and reciprocally influence the respiratory organs; for the effect of the supposed accident, whether real or the mere creation of the uncontrolled fancy, is the same. In the sensation of falling from a height, as from a precipice or the ridge of a house, (an impression which is very common in dreams of this kind,) whether it be real or imaginary, the muscles of the trunk are instinctively thrown into strong action to prevent the anticipated consequences of the accident. This vigorous action, it is well known, is in accidents an important protection against external violence of all kinds, as is proved by the fool-hardy experiments which, for a wager or pecuniary reward, some have made of allowing a carriage to pass over the chest, or a heavy

waggon over the arm, the muscles of each being in a state of rigid contraction. In the celebrated execution also of Damien, the muscles, it is said, resisted the combined force of four horses attached to his extremities, until knives were thrust into the joints to assist their separation. But, as we have already seen, for the purpose of such exertions the glottis must be closed; and it is the same in the mere delusions of a dream, as we find in night-mare, in which the chest is painfully oppressed and all attempts to scream unavailing. Even simple terror or moral agony, unconnected with the fear of physical evil to ourselves, will suspend the breathing, as in the tragic illusions of the theatre, or in some of the more powerful scenes of genteel comedy, in which it is no less physiologically than figuratively true, that the audience is in "breathless expectation" of the *dénouement* of the piece. Who, for instance, in the exquisite representation, by a Malibran, of the Somnambule walking along the parapet of a house, appearing to step over its edge, and afterwards crossing a narrow and slender plank, which seems to give way under her weight, has not felt the blood forsake the cheek, the respiration after a full inspiration completely suspended, and the limbs powerless. The reason is here held captive by the illusion of the scene, and we are just frightened children with their respiration suspended for a while. The effect is, indeed, involuntary from instinctive and associated action, but it is natural, not anormal; for that cannot be considered anormal which occurs simultaneously in hundreds of people. When the contraction of the arytænoid muscles subsides, the glottis by its own elasticity will open to a certain extent; for this is its natural medium state, when it ceases to be under the influence of muscular agency: then, a small portion of air escapes from the lungs in consequence of the natural pressure of the parietes of the thorax, but, some uneasy feeling remaining, relief is sought in a deep inspiration in the form of a sigh, and where the mind has been deeply affected, especially in nervous sensitive habits, the breathing heaves and labours, till relieved by the interrupted inspirations of sobbing. Where, then, a paroxysm of breathlessness and crowing

has been produced by fright, the closing of the glottis is the natural result, rather than a morbid condition ; and the fatal suffocation on the one hand, or the partial recovery by crowing on the other, scarcely admits of any other explanation than that of the supposition, that the muscular agents which minister to the opening of this chink have their power annihilated in the case of fatal asphyxia, impaired in the case of the crowing inspiration. These observations upon the effect of terror explain the fact, noticed by Mr. Pretty with respect to one of his own children, that, “for some time previous to his illness, he could never bear that active exercise in the arms, which a good nurse will always give a healthy child, without the respiration and circulation becoming so seriously impeded, as to give alarm for his safety to all present ;” and probably to the same general head, partly to that of weeping, should be referred the “teazing and irritation” mentioned as causes of the paroxysm by Professor Hamilton, who further states, that an attack of this malady is very apt to occur “on taking drink or food.”

Effort to swallow.—This connexion, between the effort to swallow and the closing of the glottis, is too obvious to require illustration : if proof were required, abundant evidence would be supplied by inadvertently speaking or laughing at the same instant that we are swallowing, when,—the glottis being opened by these expiratory efforts,—a portion of the “drink or food” passes into that chink, and produces a strangling cough.” The closing is here again involuntary, but it is natural ; and if a fit, therefore, is produced by such cause, it must arise, in all probability, from the imperfect operation of those agents, which should open the chink for the purpose of respiration.

Sudden application of cold.—In one instance, I have known the first paroxysm induced by the sudden application of cold water to the surface of the head in washing. This case I have already related. The effect of such an agent upon a sensitive part, especially when not accustomed to it, is to make a person hold his breath for a while ; and the very sensations experienced upon such sudden exposure to its influence,

if analysed by one conversant with the structure and attributes of the respiratory apparatus, are sufficient to prove that, under such circumstances, after drawing in a somewhat deep inspiration, the glottis is closed. Here, again, it is closed by natural, associated, and often involuntary movement, but it is by no means morbid: the failure is in the living agents, which should afterwards produce a sufficient opening for the free admission of air into the trachea and lungs. If the reed of a clarionet be pressed close to its mouth-piece, no sound is uttered; if compressed so forcibly, as to straighten too much the chink, through which air is forced into the instrument, a painfully screeching sound is produced. So, if the sides of the glottis remain closed, the atmospheric pressure upon the upper surface of the rima glottidis adds to the distress; the chest is hermetically sealed; the asphyxia is complete, and no sound is uttered: if the separation of its sides be imperfect, or, what is equivalent to it, if—like the reed of a clarionet and its mouth-piece—they are pressed too near to each other, the air rushes through a straightened aperture, and the inspiration is stridulous.

Recapitulation of causes.—I have thus considered the causes, of most frequent operation, enumerated by the best authorities, which are apt to produce the paroxysms in this complaint; and my own experience amply confirms the majority of the FACTS upon the subject which these writers have adduced. No one, however, as far as I know, has traced the mode of connexion of the predisposing and exciting causes of the disease with the phenomena which present themselves in its course; authors generally contenting themselves with alleging that it is a convulsive disease; that it arises from a variety of remote causes; and some, more minute, if not more accurate, in their speculations, referring it to an affection of the head, without, however, even an attempt to explain how it happens that this affection of the head should thus select one set of fibres, connected with this complicated chink, to the exclusion of all the others, although they all are close to each other, and derive their nervous influence from one common trunk.

It results from this examination that the predisposing causes are such as have a tendency to produce,—and do actually produce,—glandular enlargement, or to call into action a scrofulous tendency; that the exciting causes are such, as are peculiarly apt to occasion enlargement of the cervical or thoracic absorbent glands; and that the causes of the paroxysm are such, as, by natural association without morbid influence, involuntarily close the glottis; that the breathlessness, which commonly precedes the sonorous inspiration, cannot, therefore, be from this closing of the rima glottidis, which, in such cases, is perfectly normal, but must arise from defective power in those agents, whose office it is to open that chink; and, lastly, that the crowing inspiration, which is nature's imperfect cure of the temporary suspension of breathing, arises from the chink being only partially open for the admission of air, and remaining so until some explosive expiration, such as screaming, crying, coughing, or belching, shall mechanically burst open the flood-gates, and perfect the recovery from the paroxysm.

CHAPTER III.

PATHOLOGY OF THE DISEASE.

It has been all but universally believed, that in this disease, the temporary suspension of the breathing from a complete closing of the glottis, as well as the subsequent crowing inspiration from its imperfect opening, must have been the result, not of absolute or relative want of power in the opening muscles, but of excessive and abnormal contraction of those which close the glottis. Hence the addition to its generic name, by a large majority of writers upon this complaint, of some adjunct or epithet, which involves the postulate of its convulsive character. In proof of this, it may suffice to adduce a few illustrations of the designations under which it has been incidentally noticed or minutely described by medical writers from the earliest ages up to our own time. So to this very general impression may be traced the "asthma of children," the convulsive character of which has been universally conceded, of Hippocrates, Galen, Primerosius, Etmuller, Hoffman, Moss, and Herdman. Hence the "spasmodic or convulsive asthma" of Simpson, Millar, Chalmers, perhaps Burns, Rush, and many continental writers; hence the "spasm about the windpipe," of Burns and Hamilton; hence "the peculiar species of convulsion in infant children," of Clarke, and his followers; hence, also, "the spasmodic constriction of the chest and larynx," of Capuron and North; the "catarrhe suffocant nerveux," of Mauciers; and lastly, hence the "spasmodic, spurious, or nerv-

ous croup," of a crowd of English and foreign writers upon this malady.

The question, however, of the spasmodic character of this complaint has never, as far as I know, been subjected to any very rigorous examination. The first who submitted it to the test of reasoning, as well as of observation, was the celebrated Dr. Rush, of Philadelphia; but his arguments are far from conclusive upon the point, and were not, in the more advanced period of his life, satisfactory even to himself. Such, however, as they are, they are the best that have been advanced; and, from the high authority upon which they rest, they deserve, at the least, a brief consideration. This accomplished physician, then, inferred that this complaint was essentially convulsive from the following circumstances:—1st, the suddenness of the attack; 2ndly, its periodical character; 3rdly, the relief afforded by "nervous medicines;" 4thly, the absence of all the appearances and deposits of inflammation upon the lining membrane of the larynx and the trachea.

That convulsive ailments are generally sudden in their attack, is well known; and this analogy had evidently considerable influence upon the mind of Rush. But analogy and resemblance are many degrees removed from identity; and the mere suddenness of an attack is no evidence in itself of spasm, howsoever conclusive it may be against the doctrine which ascribes the laryngismus stridulus to inflammation. Nothing can be more sudden in its occurrence than either apoplexy or palsy; and yet no one would describe these diseases as convulsive.

The periodical character of the complaint, upon which also some stress has been laid, and of which Rush gives a striking example in a child whose attack returned every night at ten o'clock, would, even if established, afford but disputable evidence of its convulsive character. The most familiar example of a disease recurring with extraordinary regularity is that of intermittent fever; and yet no one has thought, on this account, of classing that complaint amongst convulsive ailments. But it is far from true that diseases, acknowledged to be

spasmodic, are universally or even generally periodical; and the statement that this laryngeal affection observes any great regularity in the period of its recurrence, is very far from unquestionable. It is, indeed, paroxysmal, but not, according to my experience, periodical; or if the latter seem to be true in a given instance, it is only apparently so, and involves a paradox. It is not the return of a certain time; it is not the pointing of the hand upon the dial to the hour of ten, by which the return of the fit is regulated, but by the continuance of sleep for a given period, probably combined with the horizontal posture. During sleep in this complaint, there is commonly an accumulation of mucus in the bronchi and trachea; "a prodigious rattling, which is scarcely sensible when they are awake, but very great when they are asleep;"¹—"the kind of noise which an increased secretion of mucus in the air passages would produce."² The connexion of this with the recurrence of a paroxysm is soon learned by the parents, who have occasionally discovered that they can anticipate and prevent the attack by awakening the child; thus verifying the observation that "the symptoms are said frequently to attack the child in its sleep, and, in their commencement, will go off upon taking it up from its cradle."³ In the case of A. W. this was observed by both parents. The child had commonly two attacks in the night. It was generally at the end of from four to five hours from its falling asleep in its bed that, after some continuance of the mucous rattle, the paroxysm returned. But if by amusement or other means the child was kept awake and from its bed for a longer period than usual, the recurrence of the fit was proportionately protracted.

The relief derived from "nervous medicines" is explicable upon other and more satisfactory principles, than the dependence of the disease upon convulsive action. Flatulency, as a contingent or consequence, is a common attendant upon this disease, and frequently produces a paroxysm. It was particularly observed by Millar, that "the stomach and bowels were often much inflated" in the asthma of children; and this distention, especially in the direction of the large extremity of the

¹ Molloy.² North.³ Underwood.

stomach, was very conspicuous in some of the cases which I have related. Since, therefore, the remedies to which Rush had recourse, especially the assafoetida in which he placed unbounded confidence, are amongst the most powerful means at our disposal for removing such flatulent accumulation, these, by removal of the cause, will intercept or remove the fits. *Causâ amotâ, tollitur effectus.*

Lastly, the absence of all inflammatory appearances and deposits within the larynx, trachea, and bronchi, though decisive against the dependance of this disease upon inflammation of the air-tubes, (the truth of which doctrine Rush was controverting,) is altogether inconclusive in establishing the proposition, that the disease is, and must be, spasmodic. There would, it must be confessed, be no escape from the adoption of such alternative conclusion, if the glottis could be closed by no other agency than inflammation upon the one hand, or spasm upon the other; but, in the words of Etmuller, "*tertia denique causa suffocationis hæret in nervis non moventibus musculos thoracis aut laryngis motui dicatos.*"⁵ It thus appears, that by three several morbid conditions, the passage of air into and through the larynx may be impeded or interrupted, 1st, by inflammatory deposit producing mechanical obstruction, and interfering with the movements of the arytaenoid cartilages, as in croup; 2ndly, by spasm of the closing muscles of the glottis, as in the earlier stages of croup, perhaps in whooping-cough; and lastly, by an enfeebled or paralytic state of the opening muscles of that chink:—and it is more than probable that "there is often a mistake made by considering the contraction of one set of muscles produced by torpor or paralysis of the antagonists for spasm."⁶

Dr. Clarke infers that this complaint "is altogether of a convulsive character," because it arises "from the same causes, and is relieved by the same remedies, as other convulsive affections." The latter part of this argument, in the abstract, was used, as we have seen, by Dr. Rush; but to justify conclusions totally different. Looking at this disease as a mere laryngeal spasm connected with teething and other causes, the latter writer meant merely to recommend assafoetida and other anti-

⁵ Colleg. Practic.—de suffocatione.

⁶ Burns.

spasmodics, according to the suggestion of Millar, to whom he expresses himself greatly indebted for a knowledge of the use of so valuable a remedy; whilst he thought that “bleeding often did more harm than good;” but Dr. Clarke meant, by the causes to which he adverts, such as are supposed to occasion vascular congestion and pressure within the cranium; and the remedies, to which he alludes, are bleeding, calomel, and such other “heroic” means, as are calculated to remove that very formidable pathological condition; whilst he denounces as inefficient “all the farrago of popular medicines—as fit drops, soot drops, assafoetida,” &c.

The existence and nature of the connexion between this disease and disturbance of the cerebral circulation I have already considered at large, and have conceded that, though rare, it does sometimes occur. It has been shown that the cerebral affection may be the original idiopathic affection, and, either directly or indirectly, the cause of all the phenomena;—directly, of the convulsions, and, sometimes, of the fatal termination,—indirectly, of the crowing; that, upon other occasions, it may be merely a concomitant arising from a constitutional malady, the common cause of both; but, that more commonly it is the consequence of the frequent interruptions to breathing which this disease implies, hydrocephalic excitement and effusion thence arising in the same way as, according to the highest authorities, they sometimes occur, and produce the fatal termination in croup and hooping-cough.⁷

But, supposing the connexion universal, it would afford no satisfactory explanation, nor has any been attempted, of the phenomena of the crowing disease; nor would it prove its convulsive nature. That inflammation of the cerebral texture is commonly attended with convulsions, is satisfactorily established by the cases recorded, amongst others, by Morgagni;⁸ Lieutaud,⁹ and Abercrombie;¹ but these convulsions

⁷ Royer Collard.; Jurine; Desrouelles; Double; Mason Good; Copland; Watt.

⁸ Epist. v. Art. 4, 6—et Epist. ix.

⁹ Lib. iii. Obs. 102, 105, 106, (a) 113, 115, 118, 120, 143, 144, 148, 149, 150.

¹ Researches on the Diseases of the Brain, &c. Cases, 25, 24, 27, 31, 36, 37. Also p. 114.

are general, often universal, not local ; and there is no one instance, recorded by either of these accurate and industrious pathologists, in which the glottis was affected ;—much less one set of its muscles to the exclusion of others which derive their nervous energy from the same common trunk. Even if it were susceptible of proof, in the absence of all other morbid change, that the head affection was the cause of the crowing, it would be still, according to the observations and reasonings of Dr. Clarke himself in other parts of his “ Commentaries,” quite as probable that the affection of the glottis might be of a paralytic character, as that it must be convulsive ; just as he represents squinting, in the worst form of cerebral disease in children, to be the result of feebleness, approaching in character to paralysis. Speaking of the second stage of the phrenitis in children, characterised by the symptoms of pressure, he says, “ those” (muscles) “ which turn the eyes outwards are the weakest, therefore lose their power in the greatest degree, and one or both the eyes are turned towards the nose, and squinting is the consequence ;” and in a foot note appended to this passage he subjoins the following interesting observation, which involves an important concession of principle : “ Squinting in all cases is probably owing to some pressure upon the origin of the nerves supplying the muscles of the eyes, and not, as some have supposed, to the eyes not having the same focus. It does not appear how this should paralyse the retracting muscles, or give an increase of strength to the adductor muscles, *either of which is equivalent to the other.*”² Indeed, throughout the whole chapter on phrenitis, this ingenious writer has generally kept in view the important distinction between the excitement of the early inflammatory stage of the disease and the torpor from pressure of its more advanced stage. “ When,” he assures us, “ the patient is cut off in the first stage of the disease, it is always by convulsions ;” and the appearances upon dissection, in addition to a turgid state of the vessels of the dura and pia mater, are described to be “ a highly vascular state of the plexus choroides and *strong marks of inflammation* on

² Comment. p. 126.

the basis of the skull," "the optic nerves being sometimes entirely imbedded in a sheath of coagulating lymph." The second stage of the disease he also sketches with a master's hand, as marked by torpor, both of the mental faculties and physical powers; and amongst the latter he enumerates squinting and the bending of the hand downwards, and of the sole of the foot inwards: these being considered by him as amongst "the usual effects of pressure."³ He further alleges, that, if death occur at this period of the complaint, there will be found a considerable quantity of water between the tunica arachnoides and the pia mater, or in the ventricles, or both. Thus convulsions are considered as the result of inflammation, torpor of pressure; but it is curious, that, throughout the whole course of a disease, involving in its progress congestion, excitement, inflammation, and effusion, he does not once allude to the occurrence, as one of its symptoms, or in any of its stages, of that "peculiar species of convulsion in infant children" which "consists in a peculiar mode of inspiration which it is difficult to describe," but is "a spasmodic inspiration, consisting of distinct attempts to fill the chest, between each of which attempts, a squeaking noise is heard." Upon the whole, therefore, the argument in favour of the convulsive character of the laryngismus stridulus, founded upon its supposed relation to disturbance of the cerebral circulation, is altogether unsatisfactory and inconclusive.

Some have thought that this disease was of a spasmodic character, because accompanied with other alleged convulsive actions; and my friend, Mr. North, must have yielded to the influence of this supposed association, when he added to the designation of Capuron, which he has adopted with a slight variation, "accompanied by general or partial convulsions."

Of the relation which the laryngeal affection bears to general convulsions, the result of cerebral excitement, I have already said enough; and as to "partial convulsions," in noticing their connexion with this malady, I arrived at the following conclusions: 1st, that the association is far from constant; 2ndly, that there is no sufficient proof that the alleged

³ Comment. p. 131.

symptoms are of a convulsive character; 3rdly, that the weight of testimony decidedly preponderates in favour of their being the result of feebleness, approaching to paralysis. I will now add, that, if these carpo-pedal contractions, which are the only "partial convulsions" alluded to, were conclusively established to be convulsive in essence, it would not justify the inference that the crowing inspiration must be spasmodic also. How constantly, in different parts of the body, do we find the combination of different or even opposite morbid conditions in the course of the same malady! How often even in the course of the same canal do we find torpor in one part, with vehement or even anormal action in another; as in the association of constipation with colic, or of the former, although it may appear a contradiction in terms, with diarrhœa! How often in the palsy of the miserable victims of intemperance is convulsive movement in one part combined with paralysis in another, and mania with both! How often is it observed in fracture of the skull, that with the torpor of pressure is associated convulsive movement from laceration, or from inflammation of the cerebral texture! How often in organic disease of the brain are intermingled the symptoms of pressure from a tumour with convulsions from surrounding inflammation! How often do we find from disease within the vertebral theca, in one part neuralgia, in another convulsive movement, in a third paralysis! These differences all admit of satisfactory explanation, into which, however, it is not necessary that I should enter. I announce them as well-ascertained facts, and as illustrative of the fallacy of the arguments, by which it has been attempted to establish the propositions, that the crowing inspiration, the carpo-pedal contractions, and the general convulsions, must have one common origin, because they sometimes co-exist in the progress of the same complaint; that they all arise from some disturbance of the cerebral circulation; and that they all are identical in essence, being of a convulsive character.

Upon the whole, then, it would appear that there is no sufficient evidence of the spasmodic character of the laryngismus stridulus. *It may be*, therefore, that the glottis is closed by

the usual exertion of natural agents in the performance of some of the most ordinary functions, as swallowing, &c. ; and *it may be*, that it remains partially or totally closed from some want of vigour in those antagonist powers, which should again efficiently open that chink for the purposes of respiration ; and to these conclusions an investigation of the remote causes and their mode of operation has already led me.

In the early part of my professional life, and, indeed, up to a comparatively late period, my opinion coincided with that almost universally prevalent, both in this country and amongst those upon the continent who believed in the existence of such a malady as contradistinguished from croup, that this complaint was spasmodic ; but, unable to trace any intimate alliance with cerebral affection, I entertained the vague notion that it was the result of some nervous sympathy, from a local irritation affecting the sensitive nervous system of children,—I knew not how,—and particularly the glottis,—I knew not why ;—excepting that I was disposed to consider it as nearly allied to the principle or law of morbid actions enunciated by John Hunter, and designated by him “contiguous sympathy:” for the teeth, the painful advance of which is amongst the most frequent remote causes of the malady, were very near to the glottis. But I was not satisfied with this explanation, if such it could be called, which appeared defective in many particulars. If minutely analysed, the statement did little more than announce the facts, that some local disturbance caused the complaint, and that such local disturbance, seated near the glottis, arose frequently from painful dentition. If more was meant, it seemed “to substitute words for ideas,” and was obnoxious to the observation of an eminent authority,⁴ that “all the arguments founded on the doctrine of sympathy and irritability are drawn *ab ignoto* ; and it seems much more conformable to reason and observation to infer that such convulsive (?) affections arise from some derangement of organization, however temporary, than to resort for an explanation of them to imaginary causes, and such as offer to the mind no satisfactory conclusions.”

It was this which led me to institute more minute and exact

⁴ Clarke.

inquiries as to the class of constitution most liable to this disease,—of which the strumous is beyond all comparison the most frequent,—as well as into the causes which directly produced it; and finding that this complaint arose from causes differing in situation and in essence, some seated in the chest, some in the mouth and gums, some upon the surface of the head, and some in the interior of the cranium, I was driven, for the purpose of obtaining a more satisfactory explanation, to seek for some intermediate link in the chain of events common to them all and of general, if not universal, occurrence in combination with the laryngeal affection, to which the symptom might be referred. The result of this inquiry has been to establish in my mind the conviction, that such common link, be the remote cause of this very peculiar symptom what it may, will, in the immense numerical majority of instances, be found to be enlargement of the thoracic or cervical absorbent glands. All the principal causes of the disease, as contradistinguished from the causes of the paroxysms, are capable of producing such enlargement, and experience confirms what a very general pathological connexion might have suggested; for I have found the relation between such enlargement and the crowing, when it has occurred, all but universal, and proved by observation during the life of the patient, or the examination of the body in fatal cases; and even in the very few instances in which it may have been difficult to detect the glandular affection, in consequence of the change of form in these glands from the compression of superjacent textures, or from their being within the thorax, the occurrence of similar symptoms might justify more than suspicion of its existence. “Une maladie ne peut dépendre que d’une espèce de lésion.”⁴

To many it may appear strange, after the evidence I have adduced of the frequent connexion between morbid enlargement of the bronchial or cervical absorbent glands and the crowing inspiration of infants, that it should have been so long overlooked by pathological inquirers. But, luckily, this disease is not very commonly fatal, and those who reflect upon

⁴ Desruelles, *Traité du Croup*, p. 148.

the mode in which *post mortem* examinations are too commonly conducted, will cease to be surprised that the connexion should, so long have eluded observation. In general, the operator, having in his examination of the thoracic viscera, inspected the cavities of the pleura and pericardium together with the great vessels, and having ascertained, by the sight and the touch, whether these important parts have undergone any change of texture, ends by cutting into the substance of the lungs, and by opening the cavities of the heart and its large vessels, that he may learn the condition of their interior texture. Having satisfied himself upon these points, he commonly contents himself without proceeding further, and thus leaves the spinal aspect of the chest obscured by the quantity of blood, which has necessarily escaped. The state of the bronchial glands, therefore, evades observation, simply because they are not subjected to examination. Those who devote more time to such anatomical inspections, have seen these enlargements, and amongst them Mr. Joseph Swan, in whose accuracy and fidelity upon all anatomical subjects I place the most implicit reliance, has not unfrequently seen them, and especially in the cases of children who have died of hydrocephalus; thus illustrating the connexion between this latter disease and scrofula so much insisted upon by Percival, Cheyne, and others, and explaining its occasional association with the laryngeal affection. And, as to the existence and the pathological relations of enlarged cervical absorbent glands, which occur much more frequently than the former, they have not been suspected of mischief; or they have perhaps partaken of the common lot of things that are obvious and lie upon the surface; their very frequency and notoriety have prevented them from being particularly noticed.

But it is not enough thus to have traced such connexion: it is requisite that I should point out what is the nature of the relation which these two occurrences bear to each other, —to associate, in fact, the symptoms as the effect, with the pathological condition as their cause. This presents to our view a field of investigation at once extensive, interesting, and intricate; involves the results of minute anatomical research,

of physiological experiments, and of pathological inquiries ; and amply verifies the observation of an eminent modern physiologist, that “ it is the knowledge of the nerves of respiration distributed on the neck, throat, and thorax, that will enlighten the physician in distinguishing symptoms of disease.”⁵

The two clusters or chains of glands, thus subject, from a variety of causes during infancy and childhood, to induration and enlargement, are in the immediate vicinity of organs of vital importance in the animal economy ; and they can therefore scarcely fail, under such circumstances of morbid increase of size and hardness, to exercise a pernicious influence upon parts with which they are then in contact. In children, indeed, absorbent glands are, perhaps, rarely sufficiently large or hard to encroach upon the area of the trachea, or to interfere in any considerable degree with the circulation of blood in either arteries or veins ; but they occasionally obstruct lymphatics in their course, and may impair materially the function of neighbouring nerves.

Many cases are upon record of glandular swellings in the neck, which have produced great distress in breathing, like asthma,⁶—therefore violent but intermitting,—and in which the symptoms have been referred to mechanical obstruction of the air tubes ; but many considerations lead me to doubt the validity of this opinion. The constant movement, the alternate dilatation and contraction of the bronchi, together with their elasticity, afford this part of the tube essential protection ; and, accordingly, in the preparation, in my possession, they may be seen piercing the mass of enlarged bronchial glands, but undiminished in their area, and unaltered in their form. Even if the converse were true, if pressure had caused an approximation of the sides of these tubes, it must be manifest that, the obstruction being permanent, the distress would be continuous ; whereas in this disease, as is well known, the attacks are paroxysmal, occurring at different, often distant, intervals, and the symptoms present themselves at a part far distant from the glands themselves.

⁵ Sir Charles Bell.

⁶ Rush in *Med. Obs. and Inq.* vol. v. p. 96.

The trachea, again, is preserved from injurious compression by its position, its shape, its elasticity, and its movements. The *glandulæ concatenatæ* are at its side, not upon its surface, over which in their utmost state of enlargement they rarely extend; whilst another gland situated upon its surface, much subject to enlargement, and occasionally attaining an enormous size,—the thyroid in bronchocele,—although it sometimes may impede the respiratory function, rarely, if ever, produces the symptoms of this disease. Imbedded in the loose cellular texture at the side of the trachea, the cervical glands, when morbidly enlarged, generally grow backwards towards the spine, and outwards in the direction of the side of the neck. It is just possible that they may push the trachea a little to one side, but I have never seen it, nor would this produce the symptoms; for Le Gallois, dividing the larynx from its attachment to the *os hyoides* without injuring the laryngeal nerves, pulled the whole tube so much forward and to one side, as to obtain a view of the movements of the glottis, which remained at least undiminished in their extent, notwithstanding the forcible and sudden change of position. They rarely, if ever, diminish the size of the trachea. This is further prevented by the form and elasticity of that canal; for it is an arch, of beautiful construction, with its pendentives much prolonged towards the formation of a counter arch; the elastic rings, of which these pendentives are composed, being tied together by firm muscular bands, and cemented to the adjoining *œsophagus* by cellular texture. The glands therefore in its neighbourhood, convex, as they are, in shape and at first touching the trachea only by a point, will receive from the form, elasticity, and perpendicular movement of the canal, a direction outwards, to which the impulse of this tube, in its alternate dilatation and contraction during the respiratory actions, must also materially contribute. Besides, it is well known that this canal will bear such pressure from without, as to produce ulceration of, and echymosis beneath its lining membrane, without involving, as its consequence, any considerable distress;⁷ and, after all, the trachea is not the organ or part of the tube essentially affected.

⁷ Lawrence.

Lastly, the glottis itself is amply protected from mechanical pressure. No gland can well reach it, for above is the elastic and moveable epiglottis nicely adjusted to its upper surface, and in frequent motion; immediately below is the incompressible cricoid cartilage, a complete ring unsusceptible of alteration of form; behind the epiglottis, which covers it, is a large open space, the pharynx, and before it nature has placed a shield-like (thyroid) protection, consisting of two plates of cartilage expanded at some little distance from the chink, strengthened by an angular union, with the additional protection, upon its interior, of muscular fibres which minister to some of the movements of the arytaenoid cartilages, and upon its outer surface, of a soft cushion,—the thyroid gland,—which, according to Sir Charles Bell, also constitutes the damper of the human laryngeal musical instrument.

This relative position of the glottis, moreover, excludes the possibility of the muscles, which alternately enlarge and contract the rima glottidis, being impeded in their action by these glands, in the way of direct apposition and compression. The glottis, (like the lady in the lobster,) rests in security behind its shield, and no gland can well reach it or its muscles, unless the thyroid or cricoid cartilage shall have been previously ulcerated. Besides, the symptoms are at a distance from the disease, and there is no other direct mode of communication between the two, than by nervous cords, through which the morbid influence, whatsoever that may be, must of necessity extend.

Neither can these glands interfere with respiration by any influence which they are capable of exerting upon the great vessels of the neck. In an instance, indeed, recorded by Felix Plater of suffocation from a gland, weighing an ounce and a half, situated close to the side of the trachea, the effect was ascribed to compression of those great vessels; but no other evidence of this pressure is offered than their contiguity to each other, and no satisfactory explanation attempted of the mode in which pressure upon these vessels could suspend the respiratory function. It is, moreover, now abundantly ascertained by experiment and observation, that even complete ob-

literation of these vessels produces no such symptoms, as are here ascribed to minor impediment from pressure.

That glands, in their enlarged and indurated state, may produce some obstruction of the lymphatics in their course, is well known; and the puffy condition of the face and especially under the eyes, occasionally observed in this complaint, may possibly be owing to this cause. But the combination is purely accidental, has no influence upon the character of the complaint, and is not the cause, because it affords no explanation of the phenomena of the disease. Since, therefore, these glands do not mechanically obstruct the air tubes, or even touch the muscles affected; since they do not compress either the great vessels, or, in any important degree, the lymphatics of the neck, no other mode of explanation remains to us, than that of some influence which they must exercise upon the respiratory nerves.

Some may possibly doubt whether glands, enlarged by the causes already mentioned, can affect nerves in their vicinity, so as materially to interfere with the ordinary functions of such nerves. Of this I shall offer abundant evidence hereafter. It may suffice, for the present, to adduce one illustration, the first of that interesting series of cases in the Appendix to the profound exposition of the nervous system by my estimable colleague, Sir Charles Bell. "From the action of mercury on the mouth, a lymphatic gland, between the mastoid process and the angle of the jaw, compressed a branch of the seventh pair of nerves; and the muscles of the face on that side were so completely paralysed, that the cheek was drawn by their antagonists, and the mouth disfigured."² Now, if a single lymphatic gland of no great bulk, recently enlarged, probably, therefore, not greatly indurated, and covered with little more than loose cellular texture and no very rigid common integuments, can produce an effect so considerable, it might be expected, that enlargement of a whole chain or cluster of similar glands, either at the origin, or in the course of other nerves, more especially if these swollen glands are subject to pressure from a tense and strong fascia, or from the vigorous

² On the Nervous System, App. p. iv.

contraction of powerful muscles under which they happen to be situated, may produce similar results; and the consequences will be more serious, if the nerves, thus implicated, be distributed upon parts, the regular action of which is essential to the continuance of life.

Those, who are conversant with the anatomical relations of the parts which are involved in this inquiry, will readily understand, that, if there be any considerable enlargement of glands situated, as the absorbent glands of the lungs are described to be by the accurate Cruikshank, “at the root of the lungs before and behind the bronchia, blending with others upon the arch of the aorta, not unfrequently between the origin of the carotids, and which are but continuations of those which follow the course of the trachea downwards,”⁹ it is highly probable that the recurrent nerve, at its origin, may be subjected to their injurious influence, seeing that this nerve upon the right side turns round the subclavian artery, as it emerges from the innominate behind which the nerve passes close to “the origin of the carotid” upon that side; whilst the left recurrent winds round the arch itself of the aorta, generally between the carotid and subclavian arteries, upon and about which these glands are, as already stated upon the most unexceptionable testimony, situated.

It is not less manifest that, if the deeper-seated chain of cervical glands, those “*quæ cum aspera arteria descendunt*,” are the subject of morbid growth, they also may frequently and injuriously affect the recurrent in its course; for they nestle in the same loose cellular texture, which forms a protecting cushion to that nerve, as it passes in the line of union of the trachea with the œsophagus. In the case of enlargement of either of these two sets of glands, but particularly the bronchial, the par vagum itself may be also implicated; and, if the cervical glands are enlarged very high in the neck, as in the space between the angle of the jaw and the mastoid process of the temporal bone, the portio dura may be implicated. It does not, however, fall within the scope of my inquiry to

⁹ *Quæ cum aspera arteria descendunt eæ utrumque pariter ejus ramum comitantur, et pulmonis grandia vasa circumstant et anteriores et posteriores.*—Haller.

investigate the effects of a diseased condition of the glands thus situated upon this portion of the seventh pair. Upon this very interesting subject the experiments, observations, and illustrations of Sir Charles Bell and Mr. Shaw have left us nothing to desire. Contenting myself therefore with merely referring, as matters of illustration, to the pathological condition of the nerves of the face so produced, I shall confine myself almost exclusively to a consideration of the effects of these enlarged glands upon the pneumogastric nerves, and more especially upon their recurrent branches, with which the croupy inspiration of infants is particularly connected.

In the course of this inquiry, I shall have occasion to refer to certain general principles, which must be either conceded to me, or proved by illustrative examples. They are these ; 1st, that morbid impressions upon nerves produce their effects upon the remote distribution of their filaments ; 2ndly, that all the branches of a common trunk have a similar disorder of function from the same morbid impression ; 3rdly, that the diseased conditions of nerves resolve themselves into those of excitement upon the one hand, and those of defective energy upon the other ; 4thly, that excitement, of which the most frequent causes are sudden mechanical impulse, vascular congestion or inflammation, structural disease, and sometimes simply functional disorder, is characterised by what modern continental writers delight to call an "exaltation of function,"—a morbid or anormal excess of nervous energy ; and, 5thly, that diminished energy, which is commonly the consequence of some extraneous pressure, or of a solution of continuity the result of accidents, of ulceration, or of wasting,¹ is characterised by an enfeebled condition of the parts, upon which the affected nerve is distributed, in all its various degrees, from simple torpor or "benumbment," up to the most complete paralysis.

These principles, almost elementary, are the general inductions and generalizations of a very extensive series of facts, and result from a minute and careful examination of the many

¹ The "atrophie" of Andral, Majendie, and other physiologists and pathologists.

individual instances of "affections of nerves," either noticed in the works of systematic writers upon the pathology of nerves, or interspersed throughout those medical records, which are accessible to all. Sufficient evidence of their truth might be adduced, had I been disposed to confine myself within such narrow limits, from a single collection of medical and surgical cases, the transactions of a society which contains amongst its associates many of the most enlightened members of our profession.² Upon a subject, however, so intricate, extensive, important, and interesting, but, as yet, confessedly in its infancy, I have thought it right to carry my inquiries further, and the result has more than amply repaid me; for, after the distinct assertion of so great an authority as Andral, that the facts accumulated upon the subject of the pathology of nerves were not very numerous,³ I was little prepared to find so much valuable information embodied in works easy of access to all, and requiring no excessive industry or research for its collection.

It was my original purpose to embody the facts, which tend to establish these general propositions, in this essay. The materials, however, grew under my hand, until they became too bulky for admission, without impairing its practical utility. Their insertion in the text would have materially interrupted the narrative, and might have withdrawn the attention of my readers from those points, which it was more important to enforce.

But, as a connected view of the subject may not be altogether devoid of interest, and as the illustrations, especially those derived from the functions, injuries, and diseases of the eighth pair and its various branches, tend to elucidate the phenomena of the disease which led me into that inquiry, I have thrown them together in an appendix, to which I may refer. Those who take an interest in such investigations will thus have an opportunity of examining the details upon which my general statements rest, of determining how far my premises

² Medico-Chirurgical Transactions

³ L'anatomie pathologique est encore peu riche en faits relatifs aux altérations des nerfs.—Précis, vol. ii. p. 852.

warrant the conclusions I have drawn from them, and of tracing the process of thought, observation, and reasoning, by which I have arrived at the inference, that this disease, the spasmodic character of which has been conceded without examination, is more allied to paralysis than to convulsive movement.

The glands affected in this disease are all seated below, and consequently beyond the reach of, the superior laryngeal nerves, which preserve, therefore, unimpaired their ordinary attributes. Supplying, as they do, the closing, to the exclusion of the opening, muscles of the glottis, together with the lining membrane of the upper edge and surface of that chink, the rima glottidis continues to be closed in those associated actions, which are always accompanied with a temporary approximation of its sides. Such are all powerful exertions of the body, swallowing, crying, sobbing, violent cough, and even fright, as well as the accidental admission of any irritating substance within the chink, which, from its extreme sensitiveness to external impressions, is commonly denominated the "*sensible glottis*."

It must, consequently, be either upon the par vagum below the origin of the superior laryngeal nerves or upon its recurrent branches, that the morbid influence of these glands must be exerted. If the cervical glands be exclusively in fault, I believe that the par vagum will be rarely implicated. These nerves are so deep-seated, are so close to, and even frequently under, the edge of the carotid artery, between which and the jugular vein they are commonly situated, that any agent which could there mechanically influence the nerves, could not fail, also, materially to interfere with the circulation in those vessels, of which, however, there is commonly no decisive, if any, evidence. But these glands are imbedded in the same cellular matrix with that, which surrounds, and to a certain extent protects the recurrent nerves; and they constitute, when in a state of morbid induration and enlargement, hard nodules in such direct contiguity and contact with the latter nerves, that these can scarcely escape their injurious effects.

If those general propositions connected with the pathology of nerves, which I have ventured to announce, are well founded, there can be little difficulty (the seat of the morbid impression being ascertained) in understanding where the symptoms will manifest themselves, and what will be the nature of those symptoms. If it be true, that such morbid impressions upon the trunks of nerves produce no effect above, and little, if any, at the precise point which is the seat of injury or disease, but principally, if not entirely, at the remote distribution of their filaments, the functional disturbance of the recurrent, consequent upon disease or injury, will betray itself in the transverse muscular bands connecting the extremities of the rings of the trachea, in the sensibility of the mucous lining of that canal, and in the movements of the glottis; and the morbid effects will be restricted to the trachea and larynx, for upon these parts alone is this nerve distributed. But if the par vagum be also affected either above or below the part which gives off the recurrent, the heart may suffer, though, according to experiment and observation, only temporarily and inconsiderably; the lungs, and especially the air cells, may be seriously affected; and the stomach, particularly its larger extremity, will not escape.

If, again, it be true that all the branches proceeding from a common trunk have a similar disturbance of function from the same injurious impression, then, if one part which derives its energy from a given source be excited, all the other parts deriving their supply from the same common trunk, will be similarly affected; so, if defective energy manifest itself in one portion of the distribution of the recurrent nerve, it may be expected that the rest of its branches will be affected with similar torpor; and since, in the laryngismus stridulus, there is no evidence of the operation or existence of any of those causes which produce excitement of a nerve; since the glands, with the enlarged and indurated states of which the disease has a common and all but invariable connexion from their texture, form, and situation, are infinitely more likely to produce direct compression than sudden impulse, neurilemmatous congestion, inflammation, or structural change of the

medullary matter of the nerves themselves, it appears, at the least, extremely probable, that this disease is more nearly allied to partial paralysis from pressure, than to convulsive movement from morbid excess of energy or of action in the nerves affected.

This may appear a startling proposition to those, whose habitual train of thought and mode of expression have referred to spasm as constituting the essence of this disease. But the prejudices of early education and impressions are not easy to eradicate; and belief, founded upon the presumed infallibility of the teachers whom we revere and the authorities which we respect, is apt to take irresistible hold of the mind, which yields to the seductions of indolence. It was long, therefore, before conviction was forced upon me by the reiterated cases which, since my attention has been more strongly directed to the subject, have presented themselves to my notice; and it may be probably the same with others. I thought "*more majorum*" that there was spasm from excess of nervous energy. The symptoms, however, if minutely examined, are not those of excitement of either the par vagum, or the recurrents; but they bear a striking analogy to those, which the experiments of physiologists have proved to be the result of an annihilation of the powers and attributes of those nerves, as where they have been tied or divided, or where a portion of them has been excised. When these respiratory nerves are excited, either by mechanical irritation with a pointed instrument, as in an experiment of Cruveilhier, or by inflammation in conformity with the pathological observations of Breschet, Autenrieth, and Gendrin, and as occurred in an interesting case recorded by Sir Astley Cooper, violent paroxysmal cough like hooping-cough, has been, I believe, universally the result; but there are no attacks of breathlessness, amounting almost to asphyxia, as occur in this complaint. The other symptoms, also, show, in this malady, a state of paralysis in the other parts supplied from the same common trunk. So the transverse fibres, behind and connecting the rings of the trachea, losing their contractile power, the sputa accumulate in the air passages; hence the "prodigious rattling in the

upper part of the aspera arteria, resembling that sound which attends where there is phlegm that cannot be got up, scarce sensible when they are awake, but very great when they are asleep," described by Dr. Molloy,⁴—"that kind of noise which an increased secretion of the mucus in the air passages would produce," noticed by Mr. North.⁵ I doubt if there is any actual increase of the secretion, as in whooping-cough in which large quantities are often thrown up; and, as the sensibility of the tube is impaired in a corresponding degree with its expelling power, whilst the mucous *râle* may be heard from one end of a large room to another, the child, as in the first case which I have related, may be cheerful or even animated, may breathe without distress, and may be altogether without cough. It is in the condition of the dog in which Brachet divided the pneumogastric nerves, the consequence of which was the immediate establishment of the "*râle muqueux*;" but without discomfiture, distress, cough, or any apparent desire to breathe better. This observation, however, applies only to those cases in which the par vagum, which endows the minute ramifications of the bronchi and the air cells with sensibility, has its functions impaired, as well as the recurrents; and under such circumstances the stomach also is affected. This organ loses much of its contractile power; the peristaltic action is suspended, whilst the pressure is continued, and it becomes distended, or, in the emphatic language of Millar, "very much inflated."⁶ The food passes through in undigested masses, often mixed with slime arising from the irritation of the mucous membrane, which, deriving its nervous energy from the ganglionic system, retains its discerning power, and is excited to morbid action by these unnatural substances and stimuli. If, on the other hand, the injurious influence be confined to the recurrents, the mucus, accumulating in the trachea, will fall back upon the air cells of the lungs, which still retain their sensibility; and occasional cough, more especially in the night when the subsidiary agency of the muscles of deglutition is lost, is very apt to occur, for the purpose of dis-

⁴ Rutty, Hist. of the Weather, &c. in Dublin, p. 111.

⁵ On the Convulsions of Infants, p. 255.

⁶ On the Asthma, p. 19.

lodging such accumulation, and to be attended, or preceded, or followed by the fit of breathlessness or asphyxia terminating in the crowing inspiration, which characterises this disease. This, too, explains the great confusion observable in the accounts of different, or even the same, writers upon the subject of this disease, describing it as "spasmodic croup," when attended with "suffocative" or "strangling cough;" the spasmodic asthma," when there is little or no cough.⁷

A consideration of the remote causes also tends to confirm this view of the nature of the malady. These, it has been already shown, are such as are calculated to produce enlargement of the cervical or thoracic absorbent glands, or of both; we have seen that in a large numerical majority of instances, according to my experience in *at least* nineteen cases out of twenty, such enlargement has been actually traced; and where such cases have been examined after death, these glands have been found either surrounding the recurrent in its course, or compressing it upon the surface, or both. Now, where glands, enlarged by disease, thus compress nerves in their course, paralysis is the general result. Four admirable examples of such influence are related by Sir Charles Bell, in the Appendix to his very interesting and ingenious work upon the nervous system, and he has not related a single instance in which a gland, placed over a nerve with the office of which it interfered, produced any other effect than torpor or paralysis. These were cases of partial paralysis of the face, from pressure, high up in the neck between the angle of the jaw and the mastoid process, by an enlarged absorbent gland upon the portio dura of the seventh pair; and it requires no great stretch of fancy or any straining of reasoning to infer that, if a small gland, so situated and little subject to additional compression from superjacent tissues, can thus occasion paralysis of a nerve with which it happens to be in contact, *à fortiori*, a chain of enlarged glands, compressed firmly by a tense fascia, and liable to still further pressure from the occasional contraction of strong muscular bands, may occasion a similar effect; and such are notoriously the relations, which the enlarged cervical

⁷ Burns, Hamilton, and many continental writers.

glands and the recurrent nerves bear to each other. The nerves are beneath, and in the same line with the glands; the latter are pressed inwards by the deep-seated strong fascia of the neck, and the occasional exertion of several muscles, as the sterno-hyoideus, the thyro-hyoideus, but especially the sterno-mastoideus, and the platysma myoides, which often, by their sudden contraction, increase the pressure and occasion a paroxysm.

Even if it were conceded that these glands acted by exciting these nerves, it would not only not explain, but would be inconsistent with, the facts. Excitement of these nerves would cause contraction of the muscles upon which the nerves are distributed; but this contraction would open the glottis, not close it, for the recurrents endow the opening, not the closing, muscles with contractile power; and there is one other consideration to which I have already adverted, and which appears to me decisive upon the point. It is this: that if the glottis were closed in this complaint by spasm, the resistance would be equal in either direction; the attempt to inspire or to expire would be equally inefficient. But we know that this is not the case; for whilst each attempt to draw in the breath seems only to add to the difficulty, the paroxysm is generally, perhaps universally, brought to a termination by some strong, and often explosive, expiration, as "coughing, belching, sneezing, or vomiting."⁸

Sometimes, even a very slight explosive expiration is sufficient, a striking example of which fell within my knowledge in the child of a patient at Bayswater. The infant had experienced many attacks, when, upon my visit on January 24, the mother expressed her delight at the manifest improvement of her child. The paroxysms of breathlessness and crowing had been less frequent and less violent, and the last, which had occurred during sleep on the preceding night, had been put an end to by a cough, so slight, as not completely to awaken the child. It is in the same way that screaming or crying often stops the attack, and produces temporary recovery. "At length, a strong expiration takes place, a fit of

⁸ Millar.

crying generally succeeds, and the child, evidently much exhausted, often falls asleep.”⁹

In this, the pathological fact admirably coincides with the experiment of the physiologist; for it was observed by Le Gallois, after a division of, and consequent annihilation of nervous energy in the recurrences, that “every effort to inspire, made by the animal, only closed the glottis more effectually; and this, on account of the pressure of the exterior column of air which still further increased the approximation of the ligaments of the glottis in consequence of their oblique position, and of the *cul de sac* which they formed upon their anterior surfaces. On the contrary, expiration was easy.”¹ Having, then, altogether detached, for a certain extent, the larynx from the trachea, he introduced the end of a syringe into the latter; the air forced through the syringe, passed freely through the larynx; but when the attempt was made, by pulling back the piston, to draw the air in an opposite direction back again through the larynx, a resistance was experienced like that which would be produced by placing the finger at the extremity of the syringe.

But the approximation of the sides of the glottis, thus produced by defective power of the opening muscles, may be either complete or partial. Where it is complete, the child is breathless, the inspiratory efforts are commonly painful and unavailing, the eyes apparently start from their sockets and are expressive of agony, the face is pallid or blueish, the lips colourless or livid, the nails purplish, the hands are firmly clenched, the back bent backwards, and, unless relief be speedily obtained, a real convulsion may terminate the scene of suffering, or the child may be carried off suddenly by asphyxia, without convulsion. More commonly, however, the glottis becoming gradually, but partially, open, air rushes through the still contracted aperture, producing the sonorous inspiration so characteristic of this disease; and this commonly announces the partial recovery of the child, the paroxysm more completely terminating in some of those violent explosive expirations to which I have before alluded. In the

⁹ Clarke, p. 87.

¹ Sur le principe de la vie, p. 199.

language of an original observer of this disease, "the child's terror sometimes augmented the disorder; he clung to the nurse, and, if he were not speedily relieved by coughing, belching, sneezing, vomiting, or purging, the suffocation increased, and he died in the paroxysm."² Where there is only an approach of the sides of the glottis towards each other, the asphyxia is not complete; but the struggles are more violent and agonizing, the vessels of the face are turgid, even those of the *conjunctiva* are loaded, tears flow plentifully without sobs, apparently forced from the secreting vessels; the face is swollen, "the countenance sometimes, but more rarely, is dark, and the vessels of the face turgid, as in apoplexy."³ "Le visage présente alors la pâleur de la syncope ou bien la rougeur et la turgescence de l'apoplexie."⁴ In these cases, the child is imperfectly strangled; its struggles are like those which, at an execution, excite such strong emotion and exclamations amongst the by-standers, when a bungling country operator has imperfectly applied the rope around the neck of the criminal.

That suffocation, howsoever sudden, is not always the result of spasm of the respiratory muscles, was known even to Etmuller, who distinctly alleges that one of its causes may be paralysis of the respiratory nerves, and the context proves that he meant those distributed to the muscles upon which the movements of the glottis depend.⁵ Burns, also, by the no very laborious method of conjecture, or at least without further evidence in its support than the knowledge that a division of the recurrensts would constrict the glottis, seems to have arrived at a similar

² Millar on the Asthma, p. 18.

³ North, p. 257.

⁴ Capuron, *Malad. des enfans*, p. 439.

⁵ "Tertia denique causa hæret in nervis et motu spirituum animalium, non moventibus musculos thoracis aut laryngis motui dicatos lethalis suffocatio supervenit, quando ex resolutione nervorum paralytica cessat partium respirationi inservientium motus." After further stating that suffocation may be also produced by spasm or convulsion of the same muscles and nerves, he adds, "percipiunt enim tales ægri angustias faucium, quasi laqueo strangulantur."—*Op. Med. De Suffocatione convulsivâ*, vol. ii. p. 226.

conclusion. But his information upon the subject appears to have been incomplete and imperfect. He has not pointed out any cause to which such paralytic affection might be referred, and he was evidently not aware of the experiments of Majendie, by which it has been definitively determined that the destruction, by their division, of nervous energy in the superior laryngeal nerves causes the glottis to remain open, and that a permanently open condition of the chink also obtains when all the four laryngeal nerves are divided.⁶ With this exception, the opinion, although conjectural, is singularly happy and ingenious; and, as far as the speculative notions of one who deserves so highly of the profession can avail any thing, it materially fortifies my argument. "The recurrent of the eighth pair," he says "seems to be often chiefly affected; and when we call the disease (spasmodic croup or acute asthma) spasmodic, we are probably often wrong; its nature being, in many instances, rather a temporary paralytic state of that nerve, or, at least, a condition unfitting it for its function;" and, in a foot note, this distinguished writer adds, "I retain the name of spasmodic croup, both because it is generally received, and as it is probable that spasm may, in certain cases, be the cause. There is, however, often a mistake made, by considering the contraction of one set of muscles produced by torpor or paralysis of the antagonists for spasm: and it is this kind of contraction which often takes place in croup, and produces, doubtless, the same feeling and effects as spasm. Inaction of both sets of muscles about the glottis would have the same effect. Where the recurrent is cut, the rima closes, and the animal dies."⁷ J. H. F. Autenrieth is also represented "to have shown" that, in spasmodic croup, the relation of which to Millar's asthma he is said to have explained, "death was sometimes the consequence of the mere palsy of the parts affected."⁸ But I have not been able to procure a sight of his original observations upon the sub-

⁶ La Glotte restoit ouverte. Mém. sur l'usage de l'épiglotte dans la déglutition, p. 6.

⁷ Principles of Midwifery, 1820, p. 716.

⁸ Edin. Med. and Surg. Journ. vol. xiii. p. 19.

ject, and am ignorant, therefore, of the mode in which he works out his proposition.

Although I have adduced strong reasons for believing that the closing, total or partial, of the glottis in this disease is commonly the result of a paralytic affection of the recurrent nerves, yet it is quite within the bounds of possibility that a spasmodic affection of the closing muscles may also produce a similar constriction. To deny this, were to commit the same error as that, which I have ventured to denounce in others, of advocating exclusive opinions with regard to the nature of this disease. We know that irritation of the extremities of the superior laryngeal nerves, as from an extraneous substance sticking within the chink of the glottis, and that active inflammation of the same surface, as in acute laryngitis, will occasion a similar crowing inspiration ; and this, probably, from convulsive closing of the glottis. It is also well known that a similar inspiration takes place in whooping-cough, from, according to the general impression, mere functional excitement of the respiratory nerves. I thus qualify the phrase with regard to whooping-cough, because it has been asserted that, in fatal cases of this disease, the pneumogastric nerves have presented such changes in their physical attributes, as to lead to the impression that they have been inflamed.⁹ At all events, it has been as-

⁹ Recent observation has led me to entertain some doubts as to the spasmodic nature of the sonorous inspiration in whooping-cough. It had often struck me as extraordinary, that a mere convulsive ailment, a merely functional disturbance of the respiratory nerves should be communicable by contagion. The analogy of chorea and epilepsy had, indeed, led me to suspect the possibility of its being occasionally the result of involuntary imitation ; but such explanation could not apply to those cases of whooping-cough, where it appeared to be conveyed from one family to another by a third person, not himself the subject of the disease. The similarity in the symptoms presented, respectively by whooping-cough and the spasmodic croup, (the latter being, after all, but a modification of the disease, which it is the object of this essay to investigate,) engendered in my mind a suspicion that there might be some connexion between enlargement of the cervical or thoracic absorbent glands, and whooping-cough ; and that such enlargement might, like the mumps, be communicable from one individual to another. This determined me to examine more minutely, than I had hitherto done, the state of these glands, should the disease present itself to my notice. During the last summer, the district of May-Fair, immediately adjoining my residence, was infested with the whooping-cough ; and within a fortnight I had

certained, as a general principle, that excitement of the trunk of a given nerve will produce effects similar to those occasioned by irritation of its extreme filaments; and, accordingly, as an irritating substance in the glottis, trachea, or bronchi, will occasion convulsive cough, it might be inferred, that any cause of excitement operating upon the trunk of the pneumogastric nerves in any part of their course would occasion similar effects. Cruveilhier, accordingly, produced violent spasmodic cough, by irritating mechanically these nerves with a pointed instrument; Breschet and Autenrieth are said to have seen these nerves inflamed in cases of violent convulsive cough, which would yield to no remedies; Sir Astley Cooper and M. Gendrin have noticed the combination of a similar cough with crowing in cases where the par vagum has been denuded by surrounding suppurative inflammation; and I have in my own possession a preparation, presented to me by Mr. Fowler, my former pupil, now a respectable practitioner at Turnham Green, in which, accompanying this crowing inspiration after a long continuance of which the child died, a small tubercle, the only structural change cognizable to the senses, somewhat larger than a coriander seed or a single grain of pearl barley after it has been swelled by boiling, was found attached to, and forming part of, one of the minute nervous threads, which were proceeding from the medulla oblongata to form the eighth pair. I dare not, indeed, affirm positively and peremptorily that this peculiar change was the cause of the paroxysms, though it is far from impossible that it may have been so. I would not venture to assert that this was the precise filament,

an opportunity of seeing not less than eight cases of this distressing malady, in every one of which the cervical glands in the line of union of the trachea with the œsophagus were greatly enlarged;—several appearing to the touch as large as hazel nuts, some even equalling the size of the last joint of the thumb. It were, indeed, too much, in the present state of our knowledge, or rather ignorance of the pathological essence of this disease, to assert that such enlargement of the glands is the cause of whooping-cough. The relation between these two events may be rather that of coincidence than causation; but the fact of their connexion is at least striking and interesting, and, as the concurrence of these events explains some of the symptoms more satisfactorily than any explanation or theory of the disease hitherto suggested, the subject, at all events, deserves further inquiry.

which, "though for better conduct's sake it was to be confined in the same sheath"¹ with the other fibrils which were destined to make up the whole par vagum, was intended to form the superior laryngeal branch. We know, however, that convulsive action of the muscles supplied by this branch may produce the crowing inspiration; that such tubercles in or upon nerves are almost invariably attended with symptoms of excitement of the nerve to which they adhere, or in the substance of which they are formed; it may be, that these were the very filaments which were "destinated from their original," to supply the closing muscles of the glottis; the child *was* the subject of "that peculiar species of convulsion in infant children," described by Dr. Clarke; and the connexion, therefore, between the two occurrences may have been more than accidental; they may have borne the relation of cause and effect. This, however, is the only instance in which I have seen or heard of such structural change; and, if it really was the cause of the symptoms,—which, after all, admits of considerable doubt,—it may, perhaps, be fairly represented as one of those exceptions, which, according to an old and trite grammatical axiom, proves the rule. It is possible, then, that the laryngismus stridulus may occasionally be a convulsive malady; but the general history of the predisposing and occasional causes of the disease, the exciting causes of the paroxysms, and the appearances upon dissection, all point to the conclusions, that such is rarely the case, and that an immense numerical majority of instances of this complaint are the result of a paralytic affection of the recurrent laryngeal nerves, produced by the compression of enlarged and indurated glands in their course.

This condition of the nerves, whilst it explains satisfactorily all the phenomena, derives essential confirmation from the structural changes observable in the nerves themselves. They will be frequently found flattened, so as to resemble tape, and so thin, as partially to transmit light: upon other occasions, however, although they may preserve their rounded form, they become atrophied or withered. These changes

¹ Willis.

I have seen in many instances, and they are strikingly exemplified in the preparation from which the annexed engravings are taken. In no one instance have I been able to recognise the slightest appearance of inflammation, which always, where the *atrophie* is the result of such disease, is found upon the borders of such withered portion; there has been no trace of the bright redness, swelling, separation of the filaments from each other, close network of vessels, increased vascularity of the interstitial cellular tissue of the nervous cords, which, according to M. Gendrin,² are the anatomical characters of acute neuritis; nor the serous infiltration, the thickening, and induration of chronic inflammation;³ nor the ramollissement of gangrenous inflammation;⁴ nor the deposit of pus amongst the filaments, the consequence of suppurative inflammation, noticed by M. Martinet;⁵ and, in the absence of all evidence of the existence of such conditions, even in any part of the course of these nerves, we are not entitled to assume them. The inference, therefore, from all this appears to me irresistible, that it is in consequence of the compression and consequent interruption to the function of these nerves that *atrophie* occurs; and this affords additional evidence, where it is found, that the cause of the symptoms throughout has been paralysis from simple pressure.

Such are the grounds upon which I rest the doctrine of the dependance of this very peculiar complaint upon paralysis of the muscles supplied by the recurrent nerves, rather than upon convulsive movement of those, which derive their energy from the superior laryngeal branches of the *par vagum*. It now remains that I notice some of those more obscure parts of the subject which, unless explained and reconciled, might be raised as objections to the opinions I have advanced.

The difficulties which have either suggested themselves to my own mind, or been noticed by others, appear to me, upon examination, to be at least consistent with the views which I entertain, and in some instances to corroborate them.

1st. It has been doubted whether glands enlarged by

² Hist. Anatomique des Inflam., tome ii. p. 142.

³ Ibid., p. 176.

⁴ Ibid., tome ii. p. 182.

⁵ Revue Méd. Juin. 1824.

simple irritation or even scrofulous disease, are capable of paralysing nerves in their course. 2ndly. Some have thought, and it is still a prevailing impression, that a moderate degree of pressure is more likely to excite, than to paralyse a nerve. 3rdly. It has been alleged that these glands are often enlarged, without producing this complaint. 4thly. It has been asserted, that this crowing inspiration has been often observed where no enlargement could be traced. 5thly. It has been argued, that if these glands acted upon the principle of compression, the pressure being permanent, the symptoms should be so too: and lastly, it has been stated, that this disease requires bleeding and calomel for its cure, which would not be the case if the disease depended upon enlargement, especially scrofulous enlargement of the glands; and each of these objections deserves and requires a brief consideration.

That enlarged glands may by compression paralyse nerves in their course, is a point which has appeared to me so well established, as scarcely to require proof, and yet a very respectable writer in a periodical journal,⁶ has expressed his doubts upon the subject. But the evidence upon this point, which I have already adduced from the valuable work of Sir Charles Bell upon the nervous system, is conclusive upon the subject.

The second objection, also, founded upon the supposed effects of various degrees of pressure, I have to a certain extent anticipated, by showing that the symptoms of this disease are not those of excitement; whilst the general question I have considered much at large in my communications upon the pathology of nerves to the *London Medical Gazette*, and the substance of which will be found in the appendix.

The allegation, that the cervical absorbent glands are frequently enlarged where there has been no crowing, is unquestionably true, but admits readily of explanation. The same writer has, with a courtesy which demands my thanks, laid some stress upon this objection, which, however, is equally applicable to all causes and cases of pressure in the vicinity of nerves. Mere contiguity is notoriously insufficient to occasion

⁶ Robertson in *Medical Gazette*, vol. xiii. p. 968.

paralysis. There must be direct compression of the nerve to produce the effect, and probably, super-incumbent pressure, as contradistinguished from extension or stretching from the nerve passing over the surface of a tumour. So in the communication, to which I have adverted,⁷ mention is made of an enlarged lymphatic gland behind the angle of the jaw which produced no injurious impression upon any nerve; yet, in the four cases, related by Sir Charles Bell, the portio dura was paralysed by a gland nearly, but probably not *exactly*, in the same situation. Enlargement of an axillary gland will sometimes paralyse one or more of the nerves of the axillary plexus, or even the whole arm may be benumbed from it; but upon other occasions, the nerves will escape; and it has been the same, *mutatis mutandis*, with the lumbar, the inguinal, and the popliteal glands. Dislocations of the humerus and femur will, also, sometimes compress contiguous nerves, occasioning paralysis; whilst, upon other occasions, the nerves are beyond the reach of pressure. Enlargement, from pregnancy or other causes, of the uterus, and ovarian or other tumours within the pelvis will occasionally paralyse, by pressure, nerves proceeding from the lower part of the spinal marrow; but upon other occasions no such affection occurs. It thus appears that tumours, or other causes of compression, placed directly over the course of a nerve, may paralyse the parts supplied by that nerve; and yet, upon other occasions of the existence of a similar disease, the nerves may be placed just beyond the reach of the injurious influence, and consequently retain their powers and attributes. It may, therefore, very well happen, that a cervical or thoracic absorbent gland, an aneurism of the aorta or of the right subclavian artery may compress and paralyse the recurrent nerve, and occasion attacks of breathlessness, often amounting to complete asphyxia; yet, upon other occasions of similar disease, the gland being one-twentieth of an inch further to one side, the nerve a twentieth of an inch to the other, no paralysis occurs. Pressure is no longer exerted upon that slender line, not exceeding the tenth of an inch, occupied by the recurrent, and the nerve consequently escapes.

⁷ Med. Gazette, April 5, 1834.

It has, however, been further alleged, that the crowing inspiration may occur without enlargement of glands. I have already conceded the possibility of this, although it is a very rare occurrence; for in each of about thirty cases which have occurred to me in succession, I have detected them in the progress of the disease. The inability of other practitioners to detect them, may be either from the natural difficulty of tracing them which sometimes presents itself, or from insufficient examination. If the thoracic absorbent glands are exclusively affected, we may suspect and believe it from the symptoms, as in the first case which I have recorded; yet we have no means of ascertaining the fact definitively, but by examination after death. There are no stethoscopic indications of such disease; and auscultation, therefore, mediate or immediate, will teach us nothing. Illustrations also of the difficulty of detecting the nature and extent, nay, even, the very existence of tumours under the fasciæ and other textures of the neck, must be familiar to all who are conversant with the relations of these parts, or with the anatomical and surgical writings of our own time with reference to this subject. "Those," says my late friend and colleague, Mr. Shaw, "who have once dissected a tumour from under this muscle, (the platysma myoides,) will never forget the strength of these fibres in the living body, though they appear so trifling in the dead subject. We can now understand why tumours of the neck, when they are enlarged, are pushed inwards; and that they may be larger than a superficial examination would lead us to suppose."⁸ Mr. Allan Burns, too, tells us that "tumours beneath the fascia are more frequent in their occurrence than those exterior to it, and are much more dangerous in their nature. Such tumours are firmly bound down by the fascia, they are flattened on their surface, are consequently large before they protrude externally, and are intimately connected with the deep-seated parts. They produce greater effect on breathing and swallowing than would be expected from their apparently small size. Indeed the extent of their adhesions can hardly be discovered, because, although they be small

⁸ Manual of Anatomy, p. 348.

and regular on their outer surface, they often stretch back amongst the muscles and vessels, and *adhere to the large nerves.*"⁹ These are the general observations of accurate anatomists and experienced surgeons, and are decisive upon the point to which they address themselves. But illustrations speak more forcibly to the mind than the strongest descriptions, and I shall therefore refer very briefly to one or two instances in which such difficulties presented themselves.

A woman had a tumour in the neck, which appeared circumscribed and about the bulk of a moderate sized orange. It was determined by the majority of a consultation of three surgeons that it ought to be removed. The surgeon, under whose care she was, had suspicions of its being malignant, and was by no means confident of its limited extent; but, sanctioned by the majority, and with the ready consent of the patient, he undertook it, albeit *invito Marte*, in the presence of the others. In the course of the operation, however, such were found to be the extensive ramifications of the tumour, that it was impracticable to remove the whole. The patient survived a few days only, and I was present at the examination of the body. The tumour, apparently of a malignant character, fungoid or encephaloid, extended to the angle of the jaw, to the spine so as to occasion absorption of the transverse processes of more than one of the cervical vertebræ, and under the clavicle to the axilla itself. The cause of death appeared to be diffuse inflammation of the cellular texture. Felix Plater has recorded an instance of suffocation, probably the laryngismus stridulus, in which a gland the existence of which does not appear to have been previously suspected, and which weighed an ounce and a half, was found in the neck, very near to the great vessels; ¹ and Dr. Rush of Philadelphia, has related a very interesting example of severe attacks of breathlessness, which he calls asthma, in which he not only suspected the existence of a tumour from the symptoms, but even directed his measures in conformity with that impression; in which, however, he could not distinguish it by the touch; and

⁹ Surgical Anatomy of the Head and Neck, p. 47.

¹ Obs. Lib. i. p. 184.

yet in which after death a tumour, obviously the cause of the symptoms, was discovered as large as an English walnut.

But these glands may also escape observation in consequence of hasty and imperfect examination. In the course of a few weeks no less than three interesting illustrations of this presented themselves to my notice.

CASE.—A child, residing in Chapel-street, Curzon-street, had been attacked, within three months of its birth, with general convulsions, for which I judged it advisable to bleed largely from the head, and to give frequent and considerable doses of calomel with other remedies, under which treatment the child recovered. Some months after this, and just after my communications upon the subject of this disease appeared in the *Medical Gazette*, a surgeon, formerly in the guards, called upon me to state, that he had seen this child who had the crowing inspiration in a very alarming degree; but he assured me that, although he had searched for such enlargement of the glands as I had described, he was unable to detect any. Upon the following evening, however, he sent for me to see this patient with him, when he at once acknowledged the imperfection of his former examination, having discovered, in the interim, the whole chain to be enlarged. The fits of strangling, succeeded by crowing, continued in spite of all that could be done, and at length on the morning of the 13th of April, it died before I could reach the house. It had fallen a victim to an attack of what the parents themselves called a “choking.” Permission being granted to examine the body, the dissection afforded unequivocal evidence of the accuracy of the views which I had entertained of the cause of this disease; and, that it may not be imputed to me that I mistate or distort facts to suit those views, I prefer giving the appearances upon dissection in the words of Mr. G. E. Blenkins, a very intelligent and industrious student, whose opportunities of examining bodies at the Mary-le-bone Infirmary have been very extensive, and whose passion is the pursuit of pathological anatomy.

² London Medical Obs. and Inq. vol. v. p. 96.

“ PATHOLOGICAL APPEARANCES.

“ *Brain*.—No unusual congestion of the vessels of the meninges or of those in the substance of the brain. The ventricles contained no fluid, and the brain was of the usual firmness in a child of that age.

“ After removing the integuments from the front of the neck, the glandulæ concatenatæ could be felt enlarged ; some of them appearing of the size of peas.

“ The muscles being removed and the par vagum traced from the top of the larynx to where it gives off the recurrent on both sides, three or four glands, as large as peas, were found upon and at the side of the recurrent, where it passes over the bronchi just after their division from the trachea.

“ On the right side, the angle formed by the arteria innominata and subclavian artery was occupied by a gland ; another behind the innominata was equal in size to a large almond, over which both the recurrent and par vagum passed, and a whole chain of smaller glands accompanied the recurrent in its course by the side of the trachea, covering and obscuring the lateral filaments which proceed to the back of that canal.

“ The mesenteric glands were much enlarged ; some of them were equal in size to pigeons' eggs. Peyer's glands at the lower end of the ileum were much developed and indurated, as well as the solitary glands.

“ The other viscera were in their normal state.”

I need hardly add, that I was present at this inspection, and can therefore amply verify the accuracy of my young friend's statement.

About the same period, when examining the body of a child in Oxford-street, one of the gentlemen present told me that at the distance of a few doors, he had under his care, a crowing child in which no glands were perceptible. I volunteered to accompany him to the house of his little patient, and found that the absorbent glands were not only sensibly but very considerably enlarged.

CASE.—Within a week of this time, I was consulted

by a very intelligent physician near Charing-cross, whose child was then the subject of this ailment. He assured me, that he had been unable to distinguish any enlargement of these glands. Examining, however, deeply under the sterno-cleido muscle about the middle of the neck, I thought I could feel at least two circumscribed tumours like peas. Within a few weeks these tumours had become so manifest, that they could be felt by the parents as well as myself; they were much enlarged, and their number had become increased, whilst the crowing had become proportionately more frequent and violent, so as to excite considerable alarm.

CASE.—I was desired to see the child of a wine-merchant in Chelsea, which, I was told, was the subject of very violent spasms. Upon my arrival at the house, I heard from the passage the crowing inspiration, which at once announced the nature of the malady. It had been subject to these attacks in a greater or less degree, from the time that it was about ten weeks old, and they were now nearly incessant. The child appeared to be almost strangled; its inspirations were very imperfect, short, laboured, and accompanied with a loud crowing or croupy sound; but, in addition to these symptoms, strong convulsive movements of the eyes, of the muscles of the face, trunk, and extremities had occurred within the last forty-eight hours. The practitioner in attendance had not detected any enlargement of the glands, and told me, that he believed there was none; but upon examination, the fingers and thumb embracing the neck from behind, I could trace not only distinct, but great enlargement of the superficial glands; and, by stronger pressure, could unequivocally ascertain, that the deeper seated glandulæ concatenatæ had partaken of disease, and were enlarged. In feeling the glands behind the line of the sterno-cleido muscle, no particular effect was produced; but pressure, to the same extent, at the edge of the trachea, produced a paroxysm which I feared might be attended with serious results. The veins of the head were extremely turgid, and appeared, from the colour, to carry ink rather than blood; and this, together with the tendency to general convulsions, led me to dread effusion upon the brain; I thought it

right, therefore, to bleed from the surface of the head, to purge actively, and to give mercurials. On the following day I learned that the loss of blood from four leeches had been considerable, that there was much difficulty in restraining the flow of blood, that the child had been frequently in a state of syncope, and that strong stimulants, including ammonia, had been required for its resuscitation. But the fits of breathlessness and crowing had been, *at the least*, equally severe; and, again, before I entered the apartment in which the child lay, I heard the sonorous inspiration as shrill and loud as ever. My fears for the child's safety were much increased, and as the exhaustion was great and it was evident that it would bear no further weakening remedies, it was agreed to give a few drops of the sp. ammon. foetid and tincture of hyosciamus, that the chest, abdomen, and spine should be well rubbed during the fits, that warm cloths should be applied to the pit of the stomach, (Gervino's remedy for cure of the disease,) and that volatiles should be placed under the nostrils during the attacks, and cold water dashed upon the face. The bowels had been copiously acted upon, and discharged their contents in the warm bath when this was had recourse to on account of the violence of the paroxysms combined with more or less of general convulsions. The child died within twenty-four hours of this last visit, having had scarcely any interruption "to its strangling and crowing fits."

In a case also communicated by a very respectable practitioner, Mr. Robertson of Manchester,³ he candidly acknowledges that if his attention had not been particularly directed to the point by the papers which I had submitted to the profession, tumid glands, which he then detected in a case in which he had a tender interest, would have altogether escaped his observation.

These cases, with the considerations naturally connected with them, lead me to receive with hesitation the statements, which have been made with great confidence, of the non-existence of any morbid enlargement of the absorbent glands in cases of crowing; and the argument, therefore, thus founded

³ Med. Gazette, April 5, 1834.

upon the want of an invariable association of the two, is far from convincing. They may exist within the thorax when they can only be ascertained by dissection; they may be difficult of detection from the compression of thickened fasciæ and superjacent muscles; or they may escape notice from imperfect examination.

The same argument is at least equally applicable to all the other assigned causes of this disease. So painful dentition, hepatic obstruction, torpor of the bowels, flatulent distention, may all occur without this peculiar malady, and the breathlessness and crowing may occur without such conditions of the gums, liver, and bowels; and yet the crowing may attend all these states;—in difficult dentition,⁴ when it is curable by lancing the gums; in torpor of the bowels or flatulent distention, when it is curable by aperients, or the assafœtida,⁵ or by “the steady employment of aperients combined with soda.”⁶ Above all, too, this argument is applicable to the doctrine, which ascribes this disease to cerebral disturbance or pressure; for head-affection may go through all its stages of congestion, excitement, inflammation, and effusion even to bursting of the brain and membranes, without crowing; whilst the latter, according to the most experienced and unbiassed of the profession, corroborated too by my own observation, very frequently occurs without a symptom of head-affection or hydrocephalic tendency; and yet the two are sometimes unquestionably associated, and in this case the latter malady must be treated with activity, or convulsions may occur. But as, under such circumstances of combination, a tendency to glandular disease may be suspected, it should make us a little cautious in having recourse to the same degree of depletion, and the same herculean doses of calomel, as under other circumstances of threatened or existing cerebral excitement. In these cases of glandular ailment the restorative powers of the constitution are commonly less vigorous, and the ability therefore to bear either violent disease or severe discipline is diminished. Besides, in such cases and constitutions, the bowels are apt to be

⁴ Etmüller, Hoffman, Hamilton, Burns, North and others.

⁵ Millar, Rush, Underwood.

⁶ Merriman.

very injuriously excited by large doses of calomel and other drastic purgatives, and thus to add the hazard of the patient by producing enlargement, inflammation, and, remotely, ulceration of the glandular follicles of the intestinal canal, attended or followed by a diseased condition of the mesenteric glands.

Why, then, it may be asked, should the sonorous inspirations from constriction of the glottis occur in some instances of these diseased conditions and not in others, which are in other respects identical in their nature? The only reply, that suggests itself to my mind, is that in one set of cases the absorbent glands, enlarged and probably indurated, press upon the recurrent nerve, whilst in others, that nerve happens to escape. If there be no such enlargement, there will be no crowing; but the former may also exist unaccompanied with the latter. It is the same with other tumours contiguous to the respiratory nerves. So aneurism of the arch of the aorta, of the *arteria innominata*, or of the right subclavian artery may exist without implicating the respiratory nerves or producing fits of breathlessness; whilst, upon other occasions, they may, even without bursting, produce fatal asphyxia from pressure upon the nerves.⁷ So, also, schirrhous or, at least, enlarged glands, cervical or thoracic, have existed without affecting the nerves; yet, upon other occasions, the recurrences being either directly compressed, or influenced through pressure upon the *par vagum*, sudden, violent, and, occasionally, even fatal attacks of distress of breathing have occurred.⁸ It is the same with the results of operations with the knife or ligatures. The recurrent nerve, it will be borne in mind, does not exceed the tenth of an inch in diameter, and, whilst in one instance there may be neither injury nor pressure exactly in the course of this line, yet in other instances, the nerve is directly within the range of the injurious impression, which, exercising its influence, will produce symptoms referrible to its remote distribution in the glottis, the muscular fibres behind the trachea and the lining membrane of this canal. In fact, the case will present all the essential phenomena of this disease.

⁷ Bourdon, Lawrence.

⁸ F. Plater, Rush, Cruikshank, Montault, Hodgkin.

Some, whose opinions I respect, see in the paroxysmal character of this disease an argument against its dependence upon enlargement of glands, which, being a permanent cause, should according to them produce a permanent effect. This, however, applies at least with equal force to the other assigned causes, and especially to vascular turgescence or excitement within the cranium. But, although it may be true that the enlarged glands constitute a permanent disease, it by no means follows that pressure is constantly exerted,—at least to an extent which is sufficient to paralyse the nerve. In some positions, and probably in a relaxed state of the muscles of the neck, there may be no morbid influence exerted. A gland, which when the neck is straight and quiescent is not directly over the nerve, may be brought in contact with its surface upon a sudden change of posture; and the muscles, then in vigorous action, may at the same time so bind down or push inwards the tumour, as to produce a morbid effect; hence in some instances we hear of the fit being produced by a sudden twisting of the neck. Or the gland, although constantly over the nerve, may require additional compression to produce the effect; hence a fit of crying, or of coughing, or even of hiccough from flatulency will not unfrequently prove the occasional cause of a fit, because in these states the muscles of the throat are notoriously in violent action. Again, the causes may vary in kind and intensity, and the size, permanence, and hardness of the tumours will vary accordingly. A bubo from simple irritation, as from chafing, will rapidly subside upon soothing the local cause; and so in this disease, within a few hours from irritation of the gums or membrane covering a tooth the glands swell, and the paroxysms occur in rapid succession; but, upon lancing the gums freely, the excitement is subdued, the glands diminish, and the fits often first become less frequent and shorter in duration, and then entirely disappear.

But the pressure, and possibly even the paralysis, may be continuous, and yet the manifestation of this state be occasional only. This, it is now well known, is often the case

in paralysis arising from local pressure upon the respiratory nerve of the face, as has been satisfactorily shown in the papers of the late Mr. Shaw upon this subject and in the observations of Sir Charles Bell. In these cases the defective power is often not observed until speaking, mental emotion, or difficulty of breathing call these muscles into vigorous action ; then, one set of muscles acting to the exclusion of their antagonists, the face is distorted. It is probably the same with the glottis. Although physiologists speak in general terms of the opening and shutting of this important chink in ordinary respiration, it must be obvious that in neither of the alternate actions of the respiratory function can it be completely closed. In inspiration it must admit the entrance inwards, in expiration it must equally allow the escape outwards of the air ; in both, therefore, it must be pervious ; and as to the slight period which intervenes between the two, the labours of the physiologist have taught us nothing upon a point, which after all, perhaps, is scarcely worthy of inquiry. We know, however, that the medium state of this elastic chink, when uninfluenced by muscular agency, is that of permeability to the ingress and egress of air. It is so in the still-born fœtus ; it is so when all nervous energy is annihilated by the division of the four laryngeal nerves, as was ascertained by an experiment of Majendie.¹ In the tranquil slumbers of the infant, and even in an adult who is in perfect health, no expansion of the nostrils, no raising of the shoulders is observable during sleep ; and it is probable, that the same thing obtains with respect to the glottis. We are unconscious of any movement of this part in ordinary respiration ; we know that it is always open unless closed for some special purpose, as to prevent the intrusion of an extraneous substance into the windpipe ; it even opens, after it has been closed, in that short expiratory action, which in the ordinary state of things, immediately succeeds the effort to swallow, and which it requires a positive and almost painful exertion to interrupt. It is upon the whole, therefore, more than probable, that in ordinary and easy respiration the muscles of the glottis are little, if at all, exerted. But when

¹ Mém. sur l'usage de l'épiglotte.

the breathing is embarrassed from any cause, as in the experiment of Le Gallois when he separated the larynx from its attachment to the os hyoides that he might see the movements of the glottis, or after the half-accomplished purpose of the suicide, when the movements of the glottis were exposed to the view of Sir Charles Bell and others; then an obvious and even considerable opening and shutting of the glottis may be seen. And, as paralysis of the muscles supplied by the respiratory nerves of the face and neck, in some cases only manifests itself when the muscles of one side, in a healthy condition, act unopposed by their antagonists, so in the glottis, the effects of the enfeebled and even paralysed state of its opening muscles is only observed in those more vigorous efforts, which are made when the respiration is hurried or impeded—as in fright, in sudden waking from sleep in consequence of some strong external impression, in screaming or crying, in coughing, or when the descent of the diaphragm is prevented by distention of the alimentary canal, whether from the accumulation of indigested or feculent matters, or simply from flatulency the result of indigestion. All violent exertions of the body will, by the closure of the glottis which such exertions imply, occasion a paroxysm. So, according to Millar, “children at play were sometimes seized;”² according to Clarke, “the attacks are often brought on by straining, by exercise,” &c.;³ and these facts curiously correspond with the results of the experiments of Le Gallois, who found after the division of the recurrents in dogs of the age of three months or more, that the embarrassment of respiration was not sufficient to destroy them; “cats, however, were more inconvenienced, and if agitated or forced to walk, often fell down as if suffocated.” In all these cases, of vigorous and forcible muscular exertion, the closing muscles of the glottis, acting without antagonists, cause such an approximation of the sides of the glottis, as, existing in one degree, may occasion a slight wheezing; in a second, and greater, may produce the crowing inspiration from the rush of air through the constricted aperture; and in a third, and still greater degree,

² On the Asthma, p. 17.

³ Commentaries, p. 88.

may hermetically seal the larynx against the admission of air, occasioning asphyxia. This latter state is generally only temporary and is commonly followed by the sonorous inspiration, which is nature's remedy rather than the essential disease; and this natural cure is brought about either by the gradual cessation of action of the closing muscles, in conformity with that universal law of muscular motion, that after contraction the fibres will relax of themselves, or from some temporary cause of pressure, which had influenced the nerves by forcing the glands inwards, being diminished or removed. Then, nervous energy being restored to the recurrent, the parts, which it supplies, recover their tone and power of action, and again open the chink for the purpose of respiration. More, perhaps, is to be ascribed to the restoration of the power of contraction in the opening, than to the cessation of action in the closing muscles, as it is found that, if the inability to inspire continues uninterruptedly for the space of about two minutes, the child then falls a victim to the disease; in the language of Capuron, "*l'enfant a été réellement suffoqué.*" Had the cause of the closing of the chink in these cases been spasm of the closing, rather than paralysis of the opening muscles, it might have been expected that in the state of relaxation of all the muscular textures preceding death, such spasm would have relaxed, and the breathing have been re-established. This happens in the most violent convulsive maladies with which we are acquainted. In fatal cases of epilepsy and puerperal convulsions in adults, and of true convulsions from cerebral excitement in infants, it is almost invariably found that it is rather in the comatose state which succeeds the attack, than in the convulsions themselves, that death commonly occurs; and even in hydrophobia, a cessation of the paroxysms generally occurs for some hours previously to the death of the patient. A very slight degree of power applied in the proper direction, would be sufficient to open the glottis in these attacks of laryngismus; but that force is lost because the muscles, which should exert it, are paralysed. In the similar condition produced by complete division of the recurrences, air could not be

drawn from above downwards by the agency of a syringe, the resistance being like that produced by putting a finger upon its extremity; but in the opposite direction, from the trachea upwards, air could be injected by the employment of very inconsiderable pressure upon the piston. So, a very moderate action of the opening muscles, when they have regained their influence, may suffice to render the glottis again pervious; or it may be, that in screaming, with which the fit often terminates, and in coughing, which is not uncommon, the expiratory effort acting, like the syringe, from the lungs upwards, may produce mechanically the same effect, and open the chink.

I may notice one other cause, which, being occasional only in its influence, will tend materially to explain why this complaint should thus occur in paroxysms, and why the attacks should occur so frequently in the night. I have already adverted to the agency of the fibrous bands at the back of the trachea in getting rid of the secretions of that tube, and have shown that these fibres, as well as the lining membrane, are supplied with nervous energy by the filaments of the recurrent. This function is aided by the subsidiary agency of the muscles of deglutition, and of that peculiar action of the cricoid cartilage, by which its anterior edge, at the moment at which the glottis is closed, is carried upwards and under the lower border of the thyroid cartilage by the contraction of the crico-thyroid muscle, which is supplied by a particular filament of a nerve from the upper laryngeal for the purpose of such associated action. During sleep, the enfeebled fibrous bands, with impaired sensibility of the lining membrane of the trachea, are deprived of this auxiliary power. Accumulation is the consequence, which, it is well known to all who have accurately observed this disease, is a common precursor of an attack. Even mothers are aware of this, and anticipate a paroxysm when they perceive "that kind of noise which an increased secretion of mucus in the air passages would produce."⁴ The mucus thus accumulated ascends and descends in the trachea, as may be ascertained by the sound, and, as it is well known, occurs

⁴ North.

with any extraneous substance in the trachea; the child, however, in consequence of the diminished sensibility of the tracheal membrane, suffers little, just as happened in the experiments of Brachet, when, having destroyed all sensibility by dividing the pneumogastric nerves, he introduced into the trachea a ball of orris root, muriatic acid gas, drops of muriatic or acetic acid, or water. The animal died of suffocation, but without apparent suffering, from the gradual accumulation of mucus clogging the air passages. And, as a foreign body in the trachea, pumping up and down that tube in the alternate actions of inspiration and expiration, at length reaches the sensible glottis, whose nervous energy is unimpaired, and produces strangling cough,² so this mucus, reaching from time to time the cricoid cartilage, is thrown, by the elevation of its anterior edge, into the rima glottidis, the action of the muscles of which causes this chink to close upon that, which operates as an extraneous and irritating substance; and, as the chink cannot open for the dislodgement of this substance, a fit of "asphyxia from impossible action of the opening muscles of the glottis"³ is the result. Hence it is that the child, after the mucous rattle has been for some little time observable, gets an attack; and hence it happens, as in the third case which I have detailed, that the attack not unfrequently occurs at stated intervals, at the ex-

² Sir Charles Bell, speaking "of bodies lodging in the larynx," explains the remissions and exacerbations of the symptoms in the same way. "It happens thus; I believe the body is loose, and is sometimes lodged in the trachea, sometimes near the glottis. When in the trachea, (the sensibility of which is much less than that of the upper part of the larynx,) the patient breathes easily; but when the body is moved towards the more sensible glottis, then comes the spasm of the muscles of the glottis, and great difficulty of breathing."—*Operative Surgery*, vol. ii. p. 14.

When a foreign body is lodged in the trachea, the cough is only occasionally distressing, and is caused in consequence of the body being driven up against the larynx, which is so irritable, that the most harassing fit of coughing is excited, till the foreign substance is either forced from the larynx, or recedes from it when the fit ceases.—Hargrave's *Operative Surgery*, p. 333.

See, also, the details of "A Case of Bronchotomy, successfully performed for the removal of a pebble from the trachea, by Wm. J. Hunt, M.D.—*Med. Chir. Tr.* vol. xii. p. 27.

³ Copland.

piration of which, the average accumulation is such, that, notwithstanding the enlarged calibre of the trachea from paralysis of the fibrous bands at its posterior part, the mucus will reach and irritate the glottis.

It has fallen to my lot to be asked upon several occasions, and in a tone of triumph as if the question afforded an unanswerable argument against the views which I have suggested of the pathological character of this disease, how it happens that this disease is curable by blood letting and calomel. I believe that where head affection co-exists, either as a cause, concomitant, or consequence, much benefit has been derived from these remedies, and, perhaps, much serious mischief from their omission. If the vascular disease within the head has been the cause of enlargement of the glands, the irritation being removed, the glands will subside or disappear, and the pressure be consequently removed. But even where there is no suspicion of head affection, temporary relief, although at a lamentable expense of constitutional power, is occasionally produced by the loss of blood. It may, for instance, allay the irritation of painful dentition, though the means are so disproportionate to the end, that their employment would be "like breaking a fly upon the wheel;" it may, by diminishing the activity of the circulation in the glands, diminish their volume, just as they decrease in size upon the death of the individual; it will enfeeble the compressing muscles of the neck, whose contraction has at least aided in the production of the paroxysms; and, lastly, by thus diminishing muscular activity, it will also tend to relax the fasciæ, which add to the compression. But in these cases, the relief is not permanent; the symptoms are diminished for a while, but often return with aggravated violence, especially when the glands have any connexion with a scrofulous taint. An eminent teacher of surgery, in whom the profession and the public have deservedly placed the highest confidence, is represented to have commenced his lecture upon scrofula in these terms: "This appellation, at present used by surgeons, is a miserable title for the diseases which it is intended to represent; it is given to a class of diseases springing from debi-

lity. If asked what scrofula is, I should say that, in its character and origin, it is debility.”⁴ If there be foundation for this opinion, it is easy to understand how injurious, in many instances, these active remedies must prove, by aggravating that state of constitution in which such glandular disease is apt to occur, and, at all events, undermining the powers of the system, and exciting to morbid action the mucous lining of the bowels, which is amongst the causes of most frequent operation in producing or aggravating disease of the mesenteric glands. As remedies, then, for crowing, these means are unnecessary or injurious, howsoever they may sometimes prove useful in combating a concomitant state of cerebral excitement, and howsoever much they may occasionally, and for a short time, palliate the symptoms.

But, in truth, these remedies do not cure the crowing, as is obvious from one of Mr. Pretty’s cases, in which, although the meningitis, the cause of the convulsions, was remedied “by leeches to the temples, blistering plaisters to the neck and head, with calomel purgatives, *yet the croupy paroxysms continued for several months*, when they ultimately yielded to the exhibition of Mist. Assafoetidæ, which was prescribed by a medical friend. It appeared here to have been continued by the force of habit, *the original cause having been removed long before the spasmodic actions were overcome.*”⁵ The facts of this case are interesting, the explanation not altogether satisfactory; for, in the first place, I more than doubt if the croupy paroxysms were spasmodic; secondly, it is much more probable, where a disease continues, that it is from the continuous operation of the producing cause than from mere habit;—reference to this latter principle being, generally, rather an evasion of a difficulty or the statement of a fact, than an explanation; and, lastly, an inveterate habit of many months standing was not likely to be broken by a little assafoetida. I incline to think that there were glandular enlargements in this child; that these were *not* cured by bleeding, blistering,

⁴ Sir Astley Cooper.

⁵ Lond. Med. and Phys. Journal, vol. lv.

and similar heroic remedies, although the head affection *was*; that they remained after the cerebral disturbance had subsided, and did not disappear until the child's general health improved; and that, during this period, assafoetida just obviated one of the causes of the paroxysms.

It may, perhaps, be further suggested as an objection to the explanation, which I have offered, of the constriction of the glottis in this disease, that, if enlarged glands can produce such results, adults should be equally subject to the complaint. But, in the first place, these deep-seated glands are not very liable to enlargement in grown persons; 2ndly, the recurrent nerve is in them more efficiently protected, the larger diameter of the trachea causing the sides of that canal to project more considerably over the mere line which separates this tube from the œsophagus, and which is the precise position which this nerve occupies; and, 3rdly, the glottis enlarges considerably at the age of puberty, and is then not so easily closed in consequence of want of power of the opening muscles. The extent of this variation in size, according to age, has been particularly noticed, (and even its extent estimated,) by Richerand as modifying the results of experiments and of disease.⁶ Even in the adult, however, difficult breathing, temporary asphyxia, and, even upon some occasions, fatal suffocation have occurred from similar enlarge-

⁶ La section des nerfs récurrents produit une suffocation moins considérable, à mesure que les animaux s'éloignent de l'époque de leur naissance. (Le Gallois, p. 192.) La dyspnée que leur occasionne la section des récurrents est moins grave à mesure qu'ils sont plus âgés. (Id, p. 193.) La raison de toutes ces différences se conçoit facilement. Elle tient à ce que, proportionnellement à la capacité des poumons, l'ouverture de la glotte dans les animaux de même âge est plus grande dans une espèce que dans l'autre; et plus grande encore dans l'adulte qu'à l'époque de la naissance dans ceux de même espèce. (Id. p. 194.)

Anatomical inspection shows that the glottis in adults is double the size it is before puberty. These differences in the size of the glottis account for the danger which, in children, accompanies the croup. (Richerand, p. 482.)

L'âge a de grandes influences sur la voix, sur sa force, et sur son timbre. Le larynx et la glotte de l'homme adulte ont beaucoup plus d'ampleur qu'ils n'en ont chez l'enfant. C'est même à l'excessive étroitesse de la glotte aux premiers âges de la vie, qu'est dû l'extrême danger des angines et du croup dans l'enfance. — *Principes de Physiologie Médicale, par Isid. Bourdon, 2 ième partie, p. 679.*

ments. Mr. Burns very truly states, that tumours connected with the deep-seated parts, and especially if adhering to the large nerves, “produce greater effect on *breathing* and swallowing than would be expected from their apparently small size; and again, “from the locality of tumours produced by enlargement of the *glandulæ concatenatæ* respiration and deglutition are soon affected, and it will generally be found that by the pressure of the swelling on the *nervus vagus* and the sympathetic nerve, the functions of the *chylopoietic viscera*, are impaired.” But, not to content myself with these very general assertions, I may confidently refer, in illustration of these facts, to the cases recorded by Felix Plater,⁵ Bonetus,⁶ Cruikshank,⁷ Rush,⁸ Lawrence,⁹ Montault,¹ Bourdon,² and Hodgkin;³ to which I may probably venture to add the following of recent occurrence. A young man was admitted into a public hospital labouring under *cynanche parotidæa*, his prominent complaint being of some difficulty in swallowing. The enlargement of the gland was very considerable, but occasioned no alarm; leeches and other appropriate remedies were applied, but without any sensible diminution of the tumour. At length, at night, he had just time to exclaim to the nurse, “Fetch the doctor, I am dying!” when he ceased to breathe. The apothecary of the institution visited him, and considered the case to be one more allied to asphyxia than to apoplexy. He attempted to let blood from the jugular vein; but scarcely a tea spoonful escaped, when the patient made one ineffectual effort to inspire. The operation of bronchotomy was then performed, and an attempt made to inflate the lungs, but without success; he never breathed again. Upon examination of his body, there was no discoverable morbid condition

⁵ Obs. Lib. i p. 184.

⁶ Lib. i. sect. 22. Obs. 3. Lib. ii. sect. 1. Obs. 3, 5, 7, 8, 136. Addit. Lib. ii. sect. 2. Obs. 4.

⁷ On the Absorbents, p. 129.

⁸ Lond. Med. Obs. and Inq., vol. v. p. 96.

⁹ Med. Chir. Tr., vol. vi. p. 228.

¹ Journ. universel et Hebdomadaire, tome ii. p. 73.

² Principes de Physiologie, partie ii. p. 643.

³ Med. Chir. Tr. vol. xvii. p. 77.

of the brain, or its membranes; the heart was healthful; the lungs had undergone no change; they did not, however, collapse upon exposure, and their cells contained a frothy mucus. Upon cutting extensively into the trachea, a considerable quantity of mucus escaped, and the lungs collapsed in proportion, but never to the extent, even when removed from the body, of lungs under ordinary circumstances, and when cut into in a similar degree. One tonsil was enlarged, and contained a little matter; and the membrane of the pharynx was slightly edematous. The glottis presented no appearance of disease; but, upon the lingual aspect of the epiglottis, there was slight edema. An eminent physiologist, who was present, at once pronounced this to be the cause of the man's death; but the explanation was satisfactory to few, if any, of those who attended the examination. The death, in its rapidity, and other circumstances so much resembled some of the cases which I have related, that I was strongly impressed with the notion that the patient died from pressure upon the par vagum. "The parotid gland sinks in behind the jaw, fills the deep excavation between this bone and the ear, and rests against the styloid process of the temporal bone, the internal carotid artery, jugular vein, and the nerves." The danger of cutting the internal carotid, or the internal jugular, or the par vagum in the attempt to extirpate those parts of the gland which are situated so deep as the space between the occiput and atlas, induced Mr. Shaw to believe "that we cannot extirpate the parotid gland;" and, if we cannot remove the gland, situated as it is thus described to be by anatomists, without the risk of wounding the par vagum, it is surely not improbable that, in some instances where, as in the case I have related, the gland is very large and hard, the same nerve may be compressed, and the characteristic symptom of that injury be produced.

CHAPTER IV

OF THE DIAGNOSIS.

THERE is much reason to believe that this disease has, not unfrequently been confounded with other ailments, with which it has many symptoms in common. Hence that great difficulty in distinguishing the various maladies of the respiratory apparatus, which led to the well-founded exclamation of Baghvi; “*O! quantum difficile est curare morbos pulmonum! O! quanto difficilior eosdem cognoscere et de iis certum dare præsidium! Fallunt vel peritissimos ac ipsos medicinæ principes.*”

Since, indeed, the introduction of a new diagnostic engine and the education of a new sense for the attainment of pathological knowledge, the stethoscope and the tutored ear have cleared up much of the obscurity connected with the precise seat and nature of diseases of the chest; but those of the air tubes, at least above the bronchi, have received little elucidation from this novel instrument for investigating complaints of the lungs and heart. It is still far from easy to distinguish the exact morbid condition of the interior of the tube, or even to determine with precision the situation of its diseases, or the texture attacked.

The complaints, with which the crowing inspiration has been most frequently confounded, have been laryngitis, either acute or chronic, cynanche trachealis, bronchitis, and whooping-cough. Between the acute laryngitis of infants, however, and cynanche trachealis, distinction would be as difficult, as it is unnecessary. They are commonly combined, constituting the

disease called "croup," or, at all events, they run into each other by such insensible degrees, that it is impossible to discriminate the mere line which separates the boundaries of the two.

But with either of those inflammatory affections of the wind-pipe, the laryngismus stridulus can scarcely be confounded. The former will be readily recognised by the preceding febrile catarrh, by the hoarse and indistinct voice, by the *continuous* distress of breathing, by the violent paroxysmal cough occurring equally by night and day, frequently, indeed, accompanied by the same sonorous inspiration as in this disease, but often followed by the ejection of an adventitious membrane, the result of inflammatory deposit, and, in its progress to its too frequent unfavourable termination, by the permanent and gradually augmenting distress in breathing, the lurid countenance, the staring and prominent eye, the restlessness, amounting to jactitation, the cold, but copious, sweat upon the surface, and the laboured action of all the subsidiary agents in respiration. In the laryngismus stridulus, on the contrary, "there is no sustained febrile action,"¹ catarrhal defluxion, or hoarseness; the breathing, only occasionally and temporarily affected, is perfectly free in the intervals; cough is neither invariable nor essential, though not unfrequent, especially in the night; and the paroxysms are brought on by circumstances which exercise little influence upon croup.

But systematic writers upon medicine, and particularly those who have devoted their attention much to children's ailments, mention another species of croup, not inflammatory, coming in fits, produced by slight causes, and manifesting itself commonly in very severe paroxysms of cough, attended or interrupted by the sonorous inspiration which occurs in ordinary croup. This complaint has been constantly confounded with the true inflammatory croup, from which, however, it is essentially distinct; and although the masterly enumeration of symptoms in Cullen's definition of the cynanche trachealis should have preserved him from this

¹ North.

error, he has certainly not escaped it. This is clear, not only from the doubts he has expressed in his *Nosology*, as to the propriety of admitting the *asthma infantum* of Millar and Rush, with the *angina epidemica* of Molloy and Rutty, as modifications of the *cynanche trachealis*,—which, upon the whole, he thought he was justified in doing,—but also from the statements in the “first lines” that croup “does not always run the course of inflammatory affections, but frequently produces such an obstruction of the passages of air as suffocates, and and therefore proves suddenly fatal;” that “the peculiar and troublesome circumstance of the disease seems to consist in a spasm of the glottis, which, by inducing a suffocation, *prevents the common consequences of inflammation;*” and that “when the disease ends fatally, it is by a suffocation seemingly depending upon a spasm affecting the glottis; but sometimes, probably, upon a quantity of matter filling the bronchiæ.”² In his account, also, of the *cynanche maligna*, is a passage which, whilst it proves that he had not been able to clear up the obscurities and difficulties, with regard to these maladies, which presented themselves to his mind, affords a striking corroboration of the observations of Millar, Molloy, Rutty, probably also Starr and Bard, with regard, at least, to some of these forms of disease, and is to the effect that the suffocation which sometimes follows the affections of the larynx and contiguous parts, is often associated with enlargement of the cervical glands.³ But Cullen was obviously misled by the error upon the same point, which Millar himself had committed, and which has been the cause, since his time, of endless mistakes and controversies. This original writer evidently confounded the two diseases, which drove him to the necessity of distinguishing two stages of the *asthma infantum*; the second stage corresponding, in all its essential features, with the true inflammatory croup. Even Rush did not escape the contagious influence of his example, and, charmed

² First Lines, vi. sect. 320, 327, 329.

³ “The acrid matter poured out in the fauces being again absorbed, frequently occasions large swellings of the lymphatic glands about the neck, and sometimes to such a degree as to occasion suffocation.”—*First Lines*, sect. 315.

with the novelty and interest of Millar's work, adopted his views and addressed to him a letter, in which he expressed strongly his obligation to him for the knowledge of an universally successful remedy, and his conviction that Home was wrong in his statement, that the "suffocatio stridula," which he had described, was the result of a morbid secretion, producing inflammation. With the candour, however, characteristic of a great mind, he subsequently acknowledged his error and retracted his opinion; though he still believed that, besides the inflammatory croup, there was also a spasmodic form of the disease identical with that described by Millar.⁴

It was the necessity of discriminating these two supposed forms of croup that led Ferriar⁵ to designate one as "spurious croup," a designation adopted by Hamilton. Underwood calls it the "chronical or spasmodic croup," whilst the majority of English and many continental writers prefer the term "spasmodic;" and both Underwood and Burns consider it as the same disease with the acute asthma, using the two expressions as synonymous or convertible. Professor Hamilton has endeavoured, not however, I think, with complete success, to establish a distinction between "a convulsive stricture of the upper part of the windpipe," connected with teething upon the one hand, and the "spurious croup" upon the other, and he treats of them in different parts of his "Hints for the treatment of the principal diseases of infants and children;" but he refers both to a similar pathological condition, denominating the former a "convulsive stricture,"⁶ the latter, or spurious croup, as "seeming to arise from a spasmodic affection of the windpipe;"⁷ thus exhibiting a refinement of language and of discrimination,

⁴ "I take great pleasure in thus publicly acknowledging a mistake which I committed in my letter to Dr. Millar, published by him in London in the year 1770, in supposing that there was *but one* species of this disorder, and that was spasmodic. I am now satisfied, from repeated observations, that there is another species which I shall take the liberty of calling the *Cynanche Trachealis humida*."

—*Rush's Med. Obs. and Inq.* vol. i. p. 140. 1794.

⁵ *Med. Hist. and Reflex.*, vol. iii. p. 199.

⁶ Page 300.

⁷ Page 366.

which exceeds my powers of apprehension. The only difference between the two, if there be any, consists in this,—that in the first there is no cough, whilst in the latter it is of frequent occurrence and of a violent spasmodic character.

I believe with Underwood, Burns, and others, that the spasmodic or spurious croup and the asthma of infants are not essentially distinct diseases; and, further, that they have a close alliance with the laryngismus stridulus. I have seen them in conjunction in the same individual; I have known them alternate with, or succeed each other in the course of the continuance of the same malady; and I have found them connected with the same glandular enlargement, and disappear with the subsidence of the tumours. The occurrence or non-occurrence of cough is purely accidental, and is not, therefore, a sufficient foundation upon which to establish a distinction. This difference depends, in a considerable degree, upon the situation of the compressing glands. When these are situated within the thorax, as in the two first cases which I have related, violent paroxysmal cough is a common occurrence; but when high in the neck only, and therefore nearer to the larynx, after, in fact, the recurrences have given off their branches to the fibrous tissue connecting the ends of the rings of the trachea and to its sensitive lining, cough is often altogether absent.

Instead, therefore, of attempting to establish a distinction between spurious, spasmodic, or, as it is sometimes termed, “chronic” croup, and the disease of which I am treating, the foregoing observations seem rather to justify the conclusions, that they are identical in essence, are depending upon the same pathological condition, arise from the same causes, follow the same course, are attended with the same danger both in kind and degree, subside *pari passu* with the diminution or disappearance of the enlarged glands, and yield to the same remedial measures.

In that modification of the laryngismus stridulus, which is attended with paroxysmal cough, it has been mistaken for, or confounded with, whooping-cough; and no more striking

illustration of their near resemblance can be given, than the instance I have related, in which an eminent physician, with whom I was in consultation, of great experience in children's ailments, of quick and acute perception, and of very accurate discernment, upon hearing a single paroxysm immediately pronounced the disease to be whooping-cough. It turned out, as I had anticipated, that the lungs were extensively diseased, and the bronchial glands greatly enlarged:—and this I mention, not to impugn the accuracy of the physician who was in attendance with me and for whom I entertain the most unfeigned respect and esteem, but to prove that, from the character of the cough alone, it may be sometimes impracticable to distinguish the two complaints.

It has been long known that, during teething, coughs of various degrees of severity are apt to occur without suspicion of inflammation, or of organic disease of the lungs or air tubes.⁸ Some of these are so violent, as to have received the forcible appellation of “*tussis ferina*,” or “*furibunda*,”⁹ to distinguish them from the whooping-cough, which the same writers have described under the designation, adopted from Willis, of the “*tussis convulsiva*.” These coughs are, by the parents and attendants, often denominated “strangling,” and have been commonly believed to be a *sympathetic* ailment, from the irritation of the gums extending itself, through the nerves, to the moving agents of the respiratory apparatus.¹

“But all arguments founded on the doctrine of sympathy and irritability are drawn *ab ignoto*, and it seems much more conformable to reason and observation to infer that such convulsive affections arise from some derangement of organization, however temporary, than to resort for an explanation of them to imaginary causes, or such as offer to the mind no satisfactory conclusions.”² Assenting to this as a general proposition,

⁸ Underwood, p. 403.

⁹ Hoffman, Etmuller.

¹ “L'espèce de toux la plus ordinaire aux enfans qui mettent des dents est la toux nerveuse; elle dépend de l'irritation, de la douleur, ou de l'état inflammatoire des gencives. Elle a tellement le caractère que je viens de lui assigner, que Frederic Hoffmann, a vu dans des dentitions difficiles, cette toux résister à toutes sortes de remèdes, et ne cesser d'elle-même qu'après la sortie des dents.” —Baumes, *Traité de la première Dentition*, p. 208.

² Clarke's Commentaries, p. 96.

liable, however, to exceptions, I have been anxious to learn to what organic derangements, if any, these coughs should be referred, and experience warrants me in affirming that it is, principally, by the intervention of enlargement of the cervical glands that painful dentition produces these paroxysmal coughs, which are generally reiterated or redoubled, and preceded, interrupted, or succeeded by the crowing inspiration; thus showing, in their most remarkable and prominent features, as well as in one of their occasional results,—cerebral congestion and its consequences,—a striking resemblance to whooping-cough. But there are also some important points of distinction.

In pertussis, the disease is generally gradual in its approach. Weeks are sometimes required for its complete developement, so that a practitioner shall be able to identify it.—In the laryngismus stridulus, the attack is generally sudden, with “no apparent warning;”³ “indeed, it is so sudden, that parents have often thought it must have been the result of some extraneous substance lodging in the windpipe.”⁴

In pertussis, the child is generally conscious of the approach of a paroxysm; it runs to its parents or its nurse to be held during a fit; or, if too young for this, it is seen, even in its disturbed sleep, to be struggling against it, and grasping the first object within its reach for support.—In the laryngismus, the child has no such previous warning;⁵ the sound of mucus in the air passages often announces to the friends a recurrence of a paroxysm, but the child sleeps, unconscious of its approach, until it awakes suddenly with a fit of breathlessness succeeded by crowing, or sometimes with a fit of strangling cough interrupted by crowing.

In pertussis, again, the paroxysms come on at all times of the day, as well as night.—In laryngismus, at least in its early stage, commonly the attack first comes on in the night, and generally after the child has had some hours of refreshing sleep.⁶

³ Clarke.

⁴ Millar.

⁵ “L’attaque est presque toujours inopinée, subite, et nocturne.”—*Capuron. Mal. des Enfans*, p. 439.

⁶ “It generally came on in the night; a child, who went to bed in perfect health, waked an hour or two afterward in a fright,” &c.—*Millar*, p. 19.

In pertussis, howsoever advanced the complaint, there is in the symptoms no difference of kind; their variation is only that of more or less; the paroxysms, beginning either with the hoop or with the cough, are merely more or less severe or frequent.—In laryngismus, a temporary suspension of breathing often begins the attack, to be succeeded by the crowing; and this, again, terminates in a fit of screaming or crying: sometimes the breath is not even temporarily stopped; but it is painfully embarrassed, and each inspiration is sonorous: in other cases, again, the breathlessness and crowing are succeeded by a violent cough, like hooping-cough, the “*tussis ferina* or *furibunda*” of teething: and, lastly, not unfrequently the whole attack resolves itself into a paroxysm of cough, so like hooping-cough that it is impossible, but by the history of the case, to distinguish the two.

Pertussis is a disease of all ages, although, from children rarely escaping exposure to the specific agent which produces it, it is generally one of the complaints of early life. Hence, therefore, it commonly occurs before the age of puberty; it is, however, wholly unconnected with teething, and is by no means confined, in point of time, to the first dentition.—Laryngismus is a complaint of very early life, and, according to Hamilton, to whose statement, however, there may be exceptions, “is peculiar to the period of cutting the deciduous teeth.”

Pertussis rarely ceases for a time and then recurs; though paroxysmal, it is uninterrupted in its progress, having an increase, an acme, and decline, going through its stages with some degree of regularity, though these vary greatly in length.—It is part of the history of laryngismus to decline or subside from time to time, and then to recur, especially as different teeth, in their advance, are inflaming the gums. It may thus, having ceased for days, or weeks, or even months, again recur with formidable and even fatal violence.

Pertussis, generally, perhaps always arises from exposure, directly, or indirectly, to contagion. Commonly, the friends can trace some communication with individuals labouring under the disease, or in attendance upon such persons. Sometimes, indeed, this cannot be ascertained, and its occurrence,

then supposed to be sporadic, is ascribed to atmospheric influence. Such, at least, is the general impression of the unprofessional public, and the profession has not been able to settle definitively the question. But, howsoever generated, it is still communicable from one to other members of a family and to persons in communication with them.—In laryngismus there is no suspicion of contagion; others in the same house, in the same room, or even in the same bed escape it; it is connected with other assignable causes; it never infects others who have accidental communication with the house, and no channel can be traced by which it can have been conveyed to the child affected.

In pertussis, lastly, there is rather a peculiar feature commonly observed, although it is neither invariable nor completely infallible as a distinctive sign, namely, the disposition to retch towards the termination of a paroxysm.—This is not generally the case with that form of this disease commonly called the spurious or spasmodic croup,—the laryngismus attended with cough,—although in some instances where the cough has been violent and very long continued I have seen it; and in each, probably, it arises from a cause common to both, the strong compression of the stomach, during a lengthened paroxysm, by the diaphragm and abdominal muscles, both in violent action.

Bronchitis is another morbid affection of the respiratory organs, which, from its resemblance, in one of its leading symptoms, to the laryngismus, may render it sometimes liable to be confounded with the latter. This symptom is the mucous rattle in the air tubes, often by the friends and attendants called “wheezing.” It has been long known to the most ordinary and even least intelligent nurses, that in early life, and especially during teething, children are very subject to such mucous rattle in the breathing, unconnected with other symptoms of catarrh, without fever, with little cough, less expectoration, and no distress of breathing, and lasting for weeks or even months. This complaint has greatly puzzled nosologists and practical writers, who have generally confounded it with bronchitis. The suffocative catarrh of Laennec comes nearest to, if it

be not identical with it, for he says, "the signs are a laryngeal and tracheal rhonchus, extremely strong, perceptible at the distance of several feet. . . . If there is cough, it is attended by a moist sibilous rhonchus; but most commonly there is *no cough*, and its absence, as well as the circumstances under which the disease usually occurs, would *seem to show that there is a paralysis of some of the powers which in the natural state produce the excretion of the pulmonary mucus.*"⁷ Similar probably in kind is the "asthenic bronchitis" of Dr. Copland,⁸ "the most common form of bronchitis which is met with in *children*, particularly in the metropolis and among the children of the poor, ill-fed and ill-clothed, and those living in cellars, ground floors, and badly ventilated lanes and apartments," "remarkably prevalent during the winter and spring," amongst the symptoms of which he enumerates, "severe paroxysms of cough," with "wheezing and oppressed breathing," "severe fits of dyspnoea," generally "followed by severe attacks of cough which often terminate in vomiting," these exacerbations being succeeded by "remissions, during which the child dozes and appears relieved," continuing "with alternate remissions and aggravations," and having a tendency to produce "impending suffocation, with congestion or watery effusion on the brain."

Mr. North has particularly noticed this amongst "the premonitory symptoms" of the complaint, and as often lasting a considerable time before other symptoms manifest themselves;⁹ and it was a marked and prominent feature of the first of the cases which I have related.

In the majority of instances, however, there is a broad line of distinction between these maladies. Bronchitis is commonly the result of some exposure to cold which can be recollected and traced; is generally preceded by the occurrence of distinct catarrh; is attended with permanently hurried, often distressed breathing; the mucous rattle continues

⁷ Laennec by Forbes, p. 80.

⁸ Dict. of Pract Med. in verbo "Bronchi," p. 251.

⁹ On the Convulsions of Infants, p. 255-6,

equally by day and night, influenced by nothing but its very recent dislodgement by a loose humid cough, with which it is accompanied ; has, at least at the commencement, accompanying fever of greater or less severity ; is not connected, or only incidentally so, with teething ; may occur, therefore, at all ages ; and has no relation to enlargement of any absorbent glands.— In laryngismus, on the contrary, there is no evidence of recent exposure to cold ; it has not succeeded an attack of catarrh, and is unattended with the symptoms of that complaint, though its existence is often suspected ; the mucous râle, though sometimes constant, has more frequently variations in extent. Now it is increased, then diminished ; often it ceases altogether, to be renewed at the end of some hours, and it is especially apt to be aggravated at night, when it seems to be connected with the sleep, for the same thing happens if the child sleep by day ;—then, the natural secretion of the air cells and bronchi accumulating, the râle is more manifest, and is known to the friends to be often the precursor of an attack of breathlessness and crowing ; the cough, when it occurs, is violent, paroxysmal, redoubled, and interrupted by a sonorous inspiration like that of whooping-cough ; there is no fever, unless after the complaint has been of some duration, when the recurrent fever of children is apt to occur from intestinal irritation ; it is commonly connected with teething, and, hence, is particularly apt to occur during the “ first dentition,” rarely, though as in some instances, which I have recorded, it was so, after that period of life ; and, lastly, according to my experience, in considerably above nineteen-twentieths of cases it is associated with enlargement of either the cervical or thoracic absorbent glands. But, after all, the greatest point of distinction will be found in the absence of the crowing inspiration in bronchitis, its presence in the laryngismus stridulus.

Still, these complaints may co-exist, and, then, the difficulty of discrimination may be enhanced. A child labouring under laryngismus may, from exposure to a cold and damp atmosphere, to a current of cold air, or to sudden vicissitudes of temperature become also the subject of bronchitis, which is then a superadded affection, the symptoms of which

will be modified by the previous disease. The cough will not, then, have the usual loose, moist, and mild character of the cough of bronchitis, but will more resemble that of whooping-cough, with which this combination of complaints is very apt to be confounded. Upon other occasions, especially in children of strumous habit and, therefore, prone to glandular ailment, the enlargement of the thoracic absorbent glands may be the consequence of the inflammatory affection of the bronchi, as happened in a case which occurred to me at Bayswater, in which the symptoms appeared to be modified, probably, by such enlargement; and this enlargement, continuing for some time after the cessation of the producing cause, left the infant for weeks subject to simple uncombined attacks of the true laryngismus stridulus without cough. In this case, however, I should state that there was some coincident enlargement of the cervical glands; but as the breathlessness and crowing continued even after these were no longer cognizable to the touch, I cannot divest myself of the opinion that the bronchial glands had also been affected. If not, the case will then resolve itself into a third form of the association of these maladies; that in which the energy of the producing cause, occasioned at the same time the inflammatory affection of the mucous lining of the bronchi, and the coincident enlargement of the glands of the neck.

Connected with the subject of diagnosis, there is another branch of inquiry at once interesting and intricate. It has been alleged and may be conceded, that the crowing inspiration of infants is occasionally associated with head affection, as has been observed by Dr Clarke, Mr. Pretty, Dr. Henry Davies, Mr. North and others, and as consists with the results of my own experience. Upon the nature of this connexion I have already dwelt at considerable length, and repetition is, consequently, unnecessary. Without entering, therefore, again into the details of this subject, I shall content myself with a few general observations.

It is in proof, and the case of W. C.¹ was probably of that kind, that cerebral excitement may be associated with as-

¹ See p. 41.

phyxia and crowing, and this generally, if not universally, by the intermediate agency of enlarged absorbent glands, in the neck, either as a consequence or coincidence; in the chest, as a concomitant of hydrocephalic excitement, as noticed by Mr. Swan, or as a cause of the latter disease, as stated by one of the greatest pathological authorities of the day, Cruveilhier.² Where the affection of the glands is the consequence of the disease within the cranium, as in the case related by Dr. Henry Davies, it is probable that the cerebral affection is of an inflammatory character; for mere congestion does not stimulate glands in the course of the lymphatics leading from the part affected; and, as in such cases active treatment is necessary, it becomes all-important to distinguish such cases from those, which, altogether unconnected with head affection, are depending singly and exclusively upon the morbid condition of the glands.

In the more marked cases we may not unfrequently trace this distinction by watching narrowly the state of circulation within the cranium, and its effects, through the brain and nervous system, upon different and distant parts. In that form which some would denominate the hydrocephalic crowing, or, with Mr. Pretty, the "cerebral croup," our suspicions should be aroused when it occurs in a family, some of the younger members of which have been carried off by hydrocephalus, proneness to which is unquestionably often a family peculiarity; when the countenance is turgid or heavy, or even greatly and permanently flushed; when the head is inordinately hot, or perspires violently; when the fontanelle *knuckles*, or is elevated greatly above the surrounding surface and pulsates violently; when the vessels of the conjunctive are loaded; when the pupil, first contracted upon the admission even of a moderate light, becomes afterwards permanently dilated, sluggish in its movements, or, still worse, insensible to light; when there is occasional strabismus, with the brow knit upon exposure to strong light or glaring colours; when there is morbid sensitiveness to sound, the child starting from its

² Médecine pratique éclairée par l'anatomie et la physiologie pathologiques, p. 15.

sleep in consequence of slight noises, (as scratching its cot or cradle,) or, if awake, is ready to jump out of the nurse's arms upon the slamming of a door, or any sudden and loud noise, or when it wakes frequently with violent screams unconnected with attacks of breathlessness and crowing; and when, above all, the child is the subject of general clonic convulsions and of fever,—at least at the beginning of the disease,—too manifest to be overlooked or mistaken: and where the head-affection is thus the cause of the malady, the symptoms precede the crowing.—But in the laryngismus, where there is no evidence of either pre-existing or coincident head-affection, the disease is particularly apt to occur to the members of a strumous family; the countenance is very frequently pallid and pasty, or waxy; the head is not inordinately hot; the fontanelle is not particularly, if at all, raised; the conjunctive is bleached, unless when the fits of breathlessness and crowing have been frequent and violent; the pupil is commonly large and sluggish, but still influenced by light; the child, like others of its age, delights to follow a candle or glaring object; there are no general convulsions and no fever. The constriction of the glottis, too, is particularly apt to be attended or followed by “that kind of noise which an increased secretion of mucus in the air passages would produce,” and very frequently with a convulsive strangling cough, which, according to the negative evidence of the best writers upon hydrocephalus, including Fothergill, Clarke, Cheyne, Gölis, Nichol, Smyth, Yeats, Cruveilhier, Burns, and Hamilton, constitute not even a common attendant, much less a characteristic feature of any one of the stages of hydrocephalus, whether during the pressure of congestion, the excitement of its inflammatory stage, or the paralysis of that permanent and fatal kind, which is the result of effusion, or of the destruction of a portion of the tissue of the brain.

The evidence of hydrocephalic disease or tendency derived from the bending of the thumbs, fingers, ankles and toes, commonly designated carpo-pedal contractions, is far from satisfactory. Many children die both of the acute and chronic hydrocephalus, without those peculiar contractions; they are absent,

according to my experience, in at least one half of the cases of *child-crowing* uncombined with other maladies, and it is said that they occur very frequently where there is neither crowing nor cerebral excitement. I believe they are, when temporary, as described by Clarke, a mere expression of agony; but when more permanent, and especially in strumous habits, they may be the result of mere feebleness, or of torpor of the nervous centres; thus bearing a close analogy to the large and sluggish pupil observed in similar constitutions, or where vascular congestion, without excitement, has been the consequence of frequent attacks of laryngismus, croup, hooping-cough, or any disease which creates great or continued embarrassment of the respiratory function.³

It has been generally in the state of venous congestion, when the countenance is lurid, and the veins over the forehead and temples are pencilled with black blood, the child sleeps heavily, and the pupil is large and sluggish, that I look upon these carpo-pedal contractions as at all hazardous; they, then, betoken cerebral pressure in that first degree, which precedes the vascular excitement about to terminate in inflammation, which has been so admirably described by Cruveilhier, who is almost the only writer who has kept this distinction constantly in view.⁴ Although, therefore, we have not “any right to

³ I have recently seen a striking instance of this influence upon the brain, produced by the impeded respiration of tubercular consumption, in the wife of a publican in Oxford-street, whom I saw in consultation with my friend Mr. Cradock. Her complexion, lips, tongue, nails, and extremities of the fingers, were as blue as those of a child labouring under cyanosis, but she has also had, within the few last months, transient attacks of palsy, and now (September, 1835) has a degree of drowsiness, with large and sluggish pupil, which, although kept somewhat at bay by diuretics, is still increasing, and whilst it has a tendency to diminish both her physical suffering, and the moral agony from the progressive advance to inevitable death, of which she is conscious, will probably shorten also the duration of her complaint.

⁴ A la compression se rattachent l'assoupissement, la diminution dans la sensibilité cérébrale, et la myotilité volontaire, l'engourdissement des facultés intellectuelles, la lenteur et l'inégalité du pouls et de la respiration, la dilatation des pupilles, les paralysies partielles et générales.—*Méd. Prat. éclairée, &c., &c.*—*Sur la Maladie Cérébrale des Enfants, ou Hydrocéphale Ventriculaire aiguë*, p. 13.

assume that the crouping noise or bent thumb must necessarily be followed by affections of the brain," yet when the latter symptom is of long continuance, is unaffected by the improvement in the condition of those parts with morbid states of which it is often associated, it then becomes a point worthy of very deliberate consideration, whether it may not denote one of those "partial palsies" alluded to by Cruveilhier, allied in character to the strabismus which arises from torpor of the voluntary muscles of the eye overcome by the involuntary movement of the trochlearis, to the sluggish and dilated pupil, the torpid bowels, and those other symptoms adverted to by the eminent pathologist, whose words I have just quoted.

Another point of distinction is here worth noticing, which is founded upon "clinical experiment and observation," for the result of which we must wait. This is the influence of active and specific agents, as emetics or purgatives upon the alimentary canal. Where the constriction of the glottis threatens general convulsions because associated with cerebral congestion or effusion, the intestinal tube is so little sensitive that large doses of emetics may be given without producing vomiting, and the vigorous administration of calomel and other stimulating cathartics may be persisted in without griping or excessive evacuation. But in cases of crowing from enlarged glands or other causes, (if there be such,) to the exclusion of preceding or concomitant head-affection, emetics produce their usual influence, and calomel, if given frequently or in large doses, will weaken, not only by the violent griping which it produces,—implying want of rest,—and by those excessive discharges which constitute a heavy drain from the circulating mass, but also by hurrying the food through the alimentary canal before the nutritive parts, separated from the feculent remnant, can be taken up by the lacteals for the nourishment of the body. I am not indeed an advocate for emetics in cerebral congestion or excitement, and should be loth, therefore, to institute any experiment with such, at least, ambiguous remedies; but we shall meet in practice with abundant opportunities of instituting judicious experiments with purga-

tives, and of ascertaining, therefore, their effects. There may be, at all events, cases enough upon the confines, as it were, of cerebral fulness or disturbance, in which it will be our duty to administer active aperients, and we must then be guided somewhat, as to a continuance of their employment, by their effects.

In illustration of this point, I may be allowed to contrast two cases which can scarcely fail to interest, even if they should not convince. The one was an instance unequivocally of vascular excitement within the cranium, the other one of the crowing inspiration supposed to be connected with cerebral disturbance.

In the first case, that of a child near Bloomsbury-square, the disease was ushered in by formidable general convulsions, on account of which the ordinary professional attendant in the family was sent for. Upon inquiry, he found that it had recently swallowed a portion of raw pear incautiously given to it by the nurse to suck; he, therefore, unhesitatingly pronounced the fit to be owing to the irritation which this had occasioned in the interior of the stomach. His treatment was adapted to this impression as to the cause of the malady, for he plied the child with emetics, beginning with ipecacuanha, and, this failing to produce vomiting, then proceeding to sulphate of zinc. A young physician, who was now consulted, had strong suspicion that the head was not altogether free; yet, as the convulsion and its succeeding somnolency had well nigh disappeared, as the evidence was in such a state of things not altogether conclusive, and as the attendant practitioner had committed himself so strongly to an opposite opinion, he, to a certain extent, compromised his sentiments by substituting purgatives for the emetics, and consented to a delay of a few hours before bleeding was had recourse to. Upon returning by appointment, however, within four hours, fearing to defer it longer, this physician was alarmed by seeing the shutters of the house closed. In the interval the child had been attacked by another convulsion, which occurred soon after he left the house and extinguished life. And although it may fairly admit of doubt, whether a

case proceeding with such rapidity to its fatal termination, would have submitted to the control of any remedies, yet it must, after all, be admitted that much valuable time was lost.

The second case occurred under my own observation in the neighbourhood of Covent-Garden. A child had been attended by a general practitioner of great respectability and very enlarged experience, who announced to me, previously to the consultation, that I was to see a case of undoubted head-affection.

This child had been recently weaned, was much reduced and skinny. It had been somewhat feverish, the excretions from the intestinal canal were faulty and already over abundant. The head was hot, the cheek a little flushed, and the fontanelle, if not projecting, was at least not sunken. The child, however, betrayed no intolerance of light or sound; the eyes were well open, and the child delighted in glaring colours, as that of a gold watch, and followed with obvious pleasure a candle in its movements. The pupil yielded to the sudden influence of strong light, but was large and somewhat sluggish. The medical attendant had observed some squinting, with slight and occasional contractions of the thumb and fingers into the palm of the hand. The belly was large and inflated, the limbs extenuated, and the veins, strongly and darkly marked, formed black meandering lines over the forehead and temples. It had experienced, too, frequent attacks of the crowing inspiration, at which times it was said to have been also convulsed; but upon minute inquiry, the fit appeared to have been merely a vehement struggle for breath, in which the features were distorted with agony, the limbs rigidly extended, and the trunk arched backwards, so as to constitute an approach to opisthotonos. But I could not learn that there had been any vehement alternate contractions of antagonist muscles, such as constitute the true clonic convulsions of morbid excitement within the cranium; nor had the "fit" been followed by somnolency.

As, however, the veins returning blood from the surface of the head were full, and as I was unable to divest myself com-

pletely of the impression produced by the decided tone of my ingenious and ingenuous friend, I was unwilling to neglect the head, and, therefore, suggested a few leeches to the forehead, an evaporating lotion to the scalp, and the combination of calomel with other purgatives. The warm bath, too, was used, if not with positive advantage, at least with obvious comfort to the child, for it delighted to paddle in the water; and, after the first day, the diet was restricted to asses' milk.

Under this treatment, however, the crowing continued unabated; the child appeared formidably exhausted; the countenance became pallid, and almost cadaverous; the conjunctive and lips were bleached; the surface was cold and clammy; the saliva, thick and tenacious, hung from lip to lip; the restlessness had been extreme, like the jactitation and inquietude of a woman sinking under flooding; the fontanelle had sunk, and the pedo-carpal contractions continued. The action upon the bowels, with griping, *had been enormous*. The napkins had been so numerous that they were brought in a table-cloth for inspection,

Less confident in my opinion of the essential nature of this malady then, than I am at present, I was disposed to think the disordered secretions as amongst the most prominent objects of attention. It was agreed that the lotion should not be applied to the head oftener than when it appeared hotter than natural, which turned out to be very seldom, and, if employed at other times, was evidently disagreeable to the child; that more moderate aperients, with mild mercurials only, should be had recourse to at distant intervals; that the child should be still supported exclusively on asses' milk; and that the warm-bath should be continued. Within three days we heard no more of convulsions, the crowing had ceased, and the whole appearance of the child had improved. This plan was continued a few days longer; a more nutritive diet was allowed; and even still less violent action of the bowels was excited. After a few days more I was paying my last visit, and about to take my leave, when my attention was arrested for the first time by a cough, like hooping-cough in all but the sonorous inspira-

tion, which was absent ; and, upon further inquiry, I learned that the child had, before the attack of supposed convulsion and crowing, been subject to this strangling cough with " wheezing," (as the mother termed it,) or the sound of mucus in the air passages. This led me to examine more particularly the *glandulæ concatenatæ*, which I found so enlarged from the angle of the jaw to the sternum and along the course of the clavicle, that when the neck was extended backwards I could, in consequence of the extenuated condition of the child, distinctly recognise them not only by the touch but even by the sight.

That, in this case, the strong apprehensions originally entertained of the existence or danger of cerebral disease were not unfounded, may, possibly, be true ; but I now believe the glandular enlargement to have been the prominent and essential evil, and the producing cause at once of the cough, the " wheezing," the struggles for breath and the croupy inspiration. The nerve principally affected was probably the recurrent, but from the inflation of stomach, from the appearance of the stools, containing, as they did, much undigested food, it is probable that the *par vagum* itself may not have altogether escaped.

It was at the end of a considerable time after my last visit, that I heard by accident of the death of this child, during the temporary absence from town of its medical attendant. After some weeks it was represented to have become again the subject of fits, without however any violent convulsive agitations of the trunk or extremities, without succeeding coma or even somnolency, to the very last ; without any loss of the senses either external or internal ; without paralysis of the sphincters ; without, in fact, any of the leading characteristic symptoms of water upon the brain : and the practitioner, who had been in communication with the medical man who had been called to the child in his absence, volunteered an acknowledgment, when I had an opportunity of conferring with him, of the probable accuracy of my views, adding, with his usual candour, " after all, I believe you were right, for

the last symptoms were more allied to disease of the respiratory, than of the cerebral, function."

There appears, then, in these two cases thus contrasted, abundant proof that in cerebral maladies potential remedies often fail to act upon the half-paralysed stomach; whilst in other children much reduced by illness, and apparently torpid from feebleness only, although symptoms may occur, which much resemble those of cerebral complaints, there may be not only no diminution, but even a morbid excess of sensibility to the impression of such agents.

One other mark of distinction I may notice, although the discrimination, at the period when it is available, is little worth, and is, then, not always conclusive. This is the mode of death. In the clonic convulsions of hydrocephalus, the death is not so sudden as in the constriction of the glottis. In the former, when about to terminate fatally, after repeated and violent fits, the attacks of which are characterized by convulsive agitations of the whole body and foaming at the mouth, these convulsive movements cease and are succeeded by coma, with paralysis of the sphincters; and in this state, the child more commonly sinks.—In fatal cases of constriction of the glottis, on the contrary, a child in previous comparative health, lively, active, and playful, exhibiting, perhaps, more than usual intelligence, loses all at once its breath without assignable cause and without any convulsive agitations of the trunk or extremities. In the agony of suffocation, for such it is, the muscles of the body and limbs are rigidly extended, until, in the language of Gölis, "the whole body becomes as stiff as a log of wood;" the spine is arched backwards as in opisthotonos; and the infant, commonly within two minutes, after one or two ineffectual inspiratory efforts dies without being once able to fill its lungs with air. It dies "*réellement suffoqué*," but not convulsed; or, if at all convulsed, not more so than is seen in animals destroyed by asphyxia from any other cause, as by hanging, drowning, or mephitic vapours; or, what is more allied to our subject, from dividing the recurrent nerves, when this is done in very young animals.

CHAPTER V.

OF THE PROGNOSIS.

THERE has been much dissonance of opinion as to the proportionate mortality, and consequent degree of hazard in this disease. Simpson, Hamilton, Clarke, and Gervino consider it as a complaint which very materially implicates the safety of the patient; North, on the contrary, thinks it rarely fatal; whilst Millar, Rush, Underwood, Merriman, and Marsh allege that it will generally yield to proper remedies. The means, however, recommended by Millar, Rush, and Underwood, although they resemble each other, differ from those suggested by Merriman; these, again, vary from the remedies advocated by Marsh; and Clarke adopts a practice different from each, and discountenanced by all.

So, Simpson assures us that it is occasionally fatal in a single fit, and that, as long as dentition continues, the child is in danger of a recurrence. Hamilton considers it as "the most formidable symptom, except convulsions, which occurs during dentition;" that "the event to be dreaded is sudden suffocation, or a severe convulsion from which the child cannot be recovered;" and that, "so long as it continues to recur in any degree whatever, danger is to be apprehended." Clarke, after acknowledging that "in one of these attacks, a child sometimes, but not frequently, dies," adds that "it rarely happens that a child recovers from an attack of this sort, unless the progress of the disorder has been in-

interrupted by a timely application of proper remedies, without general convulsions;" and, lastly, Gervino says that "very young infants are cut off by it generally before it is perceived they are ill;" but adds that, by the application of "some warm linen to the breast, the paroxysm will presently subside; the child will go to sleep again, and awake the following morning as healthy as he was before."

In Mr. North's first communication to the London Medical and Physical Journal, upon this interesting subject, he stated that "he had seen no instance in which this affection had terminated fatally;" but he subsequently relates a case, in which the child was suddenly destroyed by a severe paroxysm of general convulsions, after having suffered from the symptoms of laryngismus; an occurrence, however, which he believes "to be very rare, considering the very great frequency of the complaint."

As to the measures which have been suggested to obviate the danger of this complaint by arresting its progress, these are of such varied and contradictory character, that they can scarcely justify any inference as to the extent to which they are calculated to modify our estimate of the degree of hazard in this disease. Millar trusted almost exclusively to *assafoetida*, and highly extolled its virtues; Rush assures us in his letter to Millar that, since he had employed the same remedy, he had never lost a patient; Underwood added other anti-spasmodics, and even sedatives; Merriman confided in mild but efficient purgatives, soda, burnt sponge, small doses of *ippecacuanha*, and narcotics; Marsh had complete confidence in the curative virtues of vegetable and mineral tonics, pure and bracing air, and well-regulated diet; and, lastly, Clarke, who has mixed up the consideration of the treatment of this malady with that of convulsions in general, sanctions the use of the gum-lance when it occurs during dentition, of calomel and active aperients in repeated doses, of leeches, cupping, venesection or arteriotomy, of evaporating lotions or ice to the scalp, of opium under certain restrictions, and of the inhalation of ammonia to remove the "spasmodic affection of the muscles of respiration, which occasions the blue colour ob-

servable in patients during the continuance of a convulsion." In no other part of his works has Dr. Clarke spoken of the treatment of this complaint, and to these means, therefore, he must refer, when he alleges that "it rarely happens that a child recovers from an attack of this sort, unless the progress of the disorder has been interrupted by a timely application of proper remedies, without a general convulsion."

It is impossible not to be struck with the extreme dissimilarity of the measures, above proposed, to disarm this very peculiar disease of its terrors—a difference "far as the poles asunder," and affording ample illustration of the very unsatisfactory foundation upon which the suggestion of remedies rests, where the pathology of a disease is unsettled or obscure. In a consultation many years ago with one of the senior and most highly gifted members of the profession, after seeing a young lady, the only child of parents whose entire happiness was involved in her recovery, the first question proposed was, "What is to be done in this case?" to which the consulting physician replied with his characteristic shrewdness and quaintness, "Find out her disease first, *if we can*." So in this ailment we must "find out" its nature, before we can expect to provide remedies for its cure. This has been the main object of my inquiries, and the conclusions, to which I have been led, have a tendency to reconcile the discordant statements which have been advanced upon the subject of the medical management of this disease; for there is no one of the remedies above enumerated, which is not calculated to palliate or remove some of the symptoms or consequences of this complaint, or which, if it does not cure, may not fulfil some useful indication. It appears, therefore, from these preliminary observations that, if this disease be left to itself, it is not devoid of danger, though the degree of hazard has been as much over-rated by some, as it has been under-rated by others. My own impression is, if this disease be treated early and before the balance of circulation within the head has been much disturbed, that recovery may be expected in the majority of instances; and that those children have, upon the whole, a much better chance of being preserved, who are not subjected to very severe discipline,

than those, who, in compliance with the prevailing doctrine with regard to this complaint, have been treated by very copious bleeding, large doses of calomel, and such other remedies, as the supposition of the invariable dependance of the disease upon cerebral turgescence or excitement has suggested.

The prognosis in individual cases of this disease is principally founded upon the age of the child, upon the frequency and severity of the attacks, upon the degree to which the glands are enlarged, upon the situation and cause of such enlargement, upon the extent to which the venous circulation within, or in its course from the head is interrupted, and upon the existence or non-existence of the most formidable of all its combinations, that of arterial excitement and its consequences, including inflammation, serous effusion, and thickening of the membranes of the brain.

Millar is the only one, amongst the writers upon this disease, who has dwelt upon the prognosis, and his statements upon the subject are characteristic of his sound sense, his shrewdness, and his accuracy. "The disease," he says, "was most dangerous to very young children, and especially to those who had been recently weaned. Their delicate frames, already affected by the indispositions which naturally arise from a change of food, were soon overpowered by the addition of a disease in itself so violent."⁵ This coincides with the observation of Gervino, and consists with the results of my own experience; nor is the explanation difficult. At a very early period of life, there being no advance of the teeth to an extent sufficient to account for the occurrence of the disease, it probably arises from some constitutional taint, the early developement of which shows a degree of contamination exceedingly difficult to eradicate: and it is, further, well known that the earlier the age of any animal at which we annihilate the function of the recurrent nerve either by division or even excision of a portion, the more severe and immediately hazardous is the embarrassment of the respiratory function.⁶ The reason, given by Millar, why

⁵ On the Asthma, p. 31.

⁶ La dyspnée que leur occasionne la section des recurrens est moins grave à mesure qu'ils sont plus âgés.—Le Gallois, p. 193.

it is so particularly dangerous to those who have been recently weaned is true as far as it goes ; but it is, also, to be borne in mind that this being the period at which the teeth begin to appear, causes will be operating in continuity or, at least, rapid succession to protract the duration of the malady, or to renew it at comparatively short intervals, in conformity with the original observation of Simpson, that as long as dentition continues the child is not safe from its recurrence.⁷

Millar further states, that “if the paroxysms were very severe, of long duration, and the remissions short and imperfect, the cure might be reckoned more difficult ;” but, if the asthmatic paroxysms were moderate and of short duration, and an early attention paid to them, if the remissions were long and became more distinct upon the application of the usual remedies, a favourable event might be prognosticated. These statements would, probably, in the opinion of the majority of readers, merely denote that in the former case there was a frequent, violent, and therefore dangerous recurrence of a spasm, and that in the latter, the return of the spasm being slight and at more distant intervals, it was little hazardous ; still, as was well known to Millar, Clarke, Capuron, Gervino, and many others, a single paroxysm may destroy life, and no one can tell, beforehand, which is to contain the “charmed bullet,” that will be destructive. But, in conformity with the views which I have advanced, varied frequency, duration, and severity of the attacks imply much more than this. If the paroxysms are slight, their duration short, and their recurrence unfrequent, I should infer that the morbidly enlarged glands are neither numerous nor of excessive size ; the pressure, consequently, upon the recurrent nerve being neither very great nor continuous, there is less risk of incurable disorganization, amounting to atrophy of the nerve ; and, under such circumstances, it may be anticipated that, the glandular enlargement having subsided, the nerve, when relieved from temporary pressure, will resume its healthy function. But where the fits are reiterated, brought on by slight causes,

⁷ *Periculum hoc toto dentitionis tempore imminet.* Dissert. Med. Inaug. de *asthmate Infantum Spasmodico.* Edin. 1761.

and “often by none that we can trace,” and where they have continued for months, in addition to the occurrence of cerebral congestion, which is to be apprehended from the frequent embarrassment of breathing, there is the dread that the long continued pressure upon the nerve may occasion disorganization of the nerve itself, which, then, is apt to wither beyond the point of pressure, as happened in a case the preparation from which is in my possession, and as has not unfrequently been observed in other nerves, whether compressed, as in one case of the portio dura, by its being involved in “the stool of an abscess;”⁸ or by an osseous tumour upon the decussation of the optic nerves;⁹ or by a tubercular disease at the base of the cranium upon the olfactory nerves;¹ or by a fatty tumour in the region of the carotid upon the portio dura;² or by cold, steatomatous, encysted, or other tumours, in consequence of which the nerves were found wasted, too dry, and flattened, applied or agglutinated to the tumours;³ or, what is even still more to my purpose, by enlarged and tuberculated lymphatic glands in the neck and thorax upon the pneumogastric and phrenic nerves.⁴

In calculating as to the probable result of this complaint much will depend upon the extent, situation, and cause of the enlargement of the glands, upon which in general, if not universally, the phenomena of the disease depend. But these are points not always easy to determine. A tumour, as large as a walnut, may occur in the neck beneath the deep-seated fascia, and produce the characteristic symptoms of pressure upon the recurrent nerve, and yet may escape the observation of three intelligent physicians⁵ searching for it with assiduity and anxiety, because convinced of the existence of some tumour in that situation, but unable by the most minute examination to distinguish it.

Some of the more superficial glands near the angle of the jaw may be manifest enough, and may, under our eye, go on to suppurate; but these are not *the* cervical glands which, in their

⁸ Sir Charles Bell.⁹ Janson.¹ Berard.² Billard.³ Lobstein.⁴ Andral.⁵ Rush of Philadelphia, assisted by Dr. Kearsley, jun. and Dr. Kulen.

enlarged state, produce this disease. The crowing inspiration is the result of enlargement of absorbent glands, in their natural state about the size of coriander seeds, imbedded, together with the recurrents, in the cellular texture close to the line of union of the trachea with the œsophagus, and, therefore, under the strong muscles of the throat and the two fasciæ, by the pressure of which, in the enlarged condition of these glands, their form is modified, their external character masked, and their injurious influence materially aggravated. Hence it is that Shaw, Burns, and all the most eminent writers upon the anatomical and surgical relations of the complex and important textures and organs about the neck and throat dwell upon the difficulty of detecting the nature and connexions of tumours in such situations, and inculcate the greatest caution as to the performance of surgical operations in such regions. If, therefore, it be difficult to ascertain even the existence of such morbid state, our information must be still more incomplete as to its extent; and we shall be left to infer the degree simply and singly from the frequency and severity of the attacks. But, in general, accurate examination will enable one, accustomed to the sensations which the touch conveys, to recognise some irregularity where enlargement exists. For this purpose it is better to grasp the neck of the child from behind forwards, so that the fingers and the thumb shall feel at the same time both sides of the trachea where it lies in contact with the œsophagus; then, combining pressure with deep-seated friction or movement of the fingers and thumb upwards and downwards, we may be able to trace either a tuberculated surface, or circumscribed tumours. In one case, when I pressed firmly upon one of these tumours, I produced such a paroxysm of asphyxia as I was fearful would have extinguished life, until my apprehensions were relieved by hearing the crowing inspiration. In this way, with only one exception which I have recently seen in consultation with my friend Mr. Barker, of the Edgeware-road, in which I could not completely satisfy myself upon the point, and in which we were not able to prevail upon the friends to allow an anatomical inspection, I have been able to detect in above twenty

successive instances the tumefaction of the glands. But although, as in Rush's case before adverted to, we may not succeed in feeling them, still, if together with the crowing inspiration, (their characteristic symptom,) there be causes in existence which have a notorious tendency to enlarge these glands, as dentition, inflammatory affections of the face or scalp, cerebral inflammation, meningitis, scrofula, and, more especially, if the patient live in an impure atmosphere, or be confined to low diet and unwholesome food, it is probable that these morbid conditions have produced such secondary effect upon the glands interposed in the course of the absorbent vessels leading from the part so affected; and if, moreover, the glands in the upper part of the neck, reaching in a continuous chain from the neighbourhood of the mastoid process to the posterior edge of the sterno-cleido muscles under which the accurate Mascagni represents them to dip, be enlarged as well as those which are nearly parallel with the clavicle, it is highly probable that the upper and lower links of the chain being thus affected, the middle will not have escaped.

The enlargement of the bronchial glands is still more difficult to detect. Such morbid condition, however, may be suspected where the symptom (crowing) is present in a scrofulous habit; where the slightest exertion produces an attack; where there is frequent or constant mucous *râle*; where this is accompanied with occasional cough, like hooping-cough, without co-existing catarrh or other inflammatory affection of the lungs or air-tubes; and where its remote origin can be traced to bronchitis, hooping-cough, or any severe disease of the lungs or pericardium, especially scrofulous abscess of the former,⁶ or suppurative inflammation of the latter.⁷ Even in the worst forms of enlargement of the absorbent glands, the stethoscope affords us no satisfactory information, as was obvious in the case, to which I have before alluded, in which both the phrenic nerves were implicated in, and atrophied by the pressure of a mass of glands within the chest.⁸

The situation of these tumours will, also, to a certain extent

⁶ Case ii. p. 25.

⁷ Clarke's case, Com. p. 96.

⁸ Andral, Clin. Méd. Malad. de Poitrine. Obs. 21.

modify the results. They are more dangerous, *cæteris paribus*, in the chest than in the neck, and more hazardous the nearer to its origin from the par vagum that the recurrent happens to be compressed by them. The explanation of this is obvious and satisfactory. If the glands be enlarged within the thorax, they will influence all the branches of the recurrents upwards, agreeably to the general law, that all the branches of a given nerve suffer in a similar way from the same morbid impression; and, therefore, not only will the opening muscles of the glottis be affected, but, the sensibility and expelling power of the trachea being also diminished, mucus will accumulate in the air tubes and, falling back upon the air cells, will occasionally embarrass the lungs themselves. In such case, also, these glands may, by mere contiguity, irritate the lungs to the production of cough; and this is often attended with crowing from their coincident effect, through the recurrent, upon the muscles of the glottis; thus giving rise to the form of disease commonly denominated spasmodic croup. They may, at the same time, affect the function of the par vagum below the origin of the recurrent, and thus produce permanent dyspnœa, as in Andral's case, and, at the same time, indigestion with distension of the stomach, as in some of the instances which I have recorded. These conditions, respectively, of the respiratory and the digestive functions cannot fail to aggravate the disease and increase the danger; the former adding to the distress, and interfering with the subsidiary agency of respiration upon the chyle, which is to pass through the lungs; the latter, by defective nourishment, impoverishing the constitutional powers so as to render them less able to struggle against the repeated attacks of cough, breathlessness, and crowing.

The causes which may have produced the morbid enlargement of the glands, will also essentially influence our opinion as to the probable termination of this disease.

If, in a child previously and perfectly healthful, the complaint be produced simply by dentition, we may conclude, with Mr. North, that the symptoms produced will be such, as "we know from experience will pass off without injury to the

patient in nineteen cases out of twenty, with appropriate treatment.”⁹

If they have originated in some acrid excoriation or inflammation of the integuments of the face or scalp, then, inasmuch as these local irritations are susceptible of relief, the enlarged glands resulting from them may, also, be expected to subside, and the child to recover.

If the morbid condition of the glands be connected with a strumous constitution, much may be done to improve the state of the child. Under such circumstances, indeed, the disease may continue for months, and yet, upon change of air and the employment of such other remedies as experience has sanctioned in that very obstinate malady, the attacks of breathlessness may become less severe and frequent, and the child, at length, be perfectly and permanently cured, as happened in a sister of the first child whose case I have related, to A. W. who recovered upon going to Clifton, and to the child which benefited in its general health by being taken to Southampton, though without a cure of the mucous *rôle*; but perfectly recovered upon returning to the more healthy part of Mary-le-bone.¹ Upon the whole, however, there is some hazard in these cases, as slight causes are apt to produce a recurrence of the complaint after it has apparently ceased, and because the glands, once excited to strumous inflammation, are but too apt to go on to that imperfect suppuration, which characterizes so forcibly the constitutional peculiarity; producing serious results if seated under the cervical fasciæ, but almost necessarily mortal if such suppurative inflammation occur in the bronchial glands.

If the cause be inflammation, common or specific, of the brain or its membranes, the complaint is much more serious. Luckily, this cause, much insisted upon by the late Dr. Clarke, is, according to my experience, comparatively

⁹ On Convulsions, p. 264.

¹ This child has since been confined for some months to the sofa by an indolent affection of the knee, and has had, for a very lengthened period, an imperfectly suppurating gland just below the symphysis of the lower jaw; both strongly indicative of her class of constitution.

rare. I am not, indeed, prepared to go to the full extent of Dr. Marsh's statement upon this point, that "it is more than doubtful whether in this affection, at its commencement, the brain is at all involved;"² "but I appeal to the profession generally, whether in the present day there does not exist a disposition in the disciples of some eminent teachers, to look upon every slight convulsive affection of children as a certain evidence of serious and alarming disease of the brain, and to institute a formidable, painful, and I fear frequently destructive mode of treatment, for a malady which exists only in their own imagination. Hence we have a ready explanation of the great number of the cures of 'hydrocephalus,' which swell the common-place book of some practitioners, and which are presumed to do honour to their singular foresight and active practice."³ That, however, these two complaints may co-exist, is unquestionable; and whether the head-affection be a cause, concomitant, or consequence, it must of necessity render the case infinitely more unmanageable and hazardous, and, consequently, the prognosis much more unfavourable.

If the crowing inspiration accompany, or have been preceded by bronchitis, this inflammation is probably the cause; but although it embarrasses the treatment somewhat, it only indicates the necessity of the more active employment of remedies; for, in such case, a child may be carried off unexpectedly and suddenly by the closing of the windpipe from the influence of the enlarged glands, when, had the inflammation of the bronchi existed uncombined, there would have been little doubt of the child's recovery. In fact, these two states have a material and reciprocal influence upon each other. The affection of the recurrent nerve diminishing the sensibility of the lining membrane, as well as the expelling power of the tube, the increased secretion will accumulate and, by embarrassing the lungs, increase the cough; whilst the frequent occurrence of cough, enlarging, as it does, the sphere of movement of the glottis, will occasion its sides to ap-

² Dublin Hosp. Rep., vol. v. p. 620.

³ North on Convulsions, &c. p. 263.

proximate to each other in a degree, which the enfeebled opening muscles are incapable of counteracting; and the fits of breathlessness with crowing will be, consequently, more frequent, reiterated, and severe.

The same observations will apply to other diseases of the chest, especially abscess of the lungs, when attended with enlarged bronchial glands and crowing as the consequence of the latter. They mutually influence each other, and enhance reciprocally, the danger of each. The cough, which attends these maladies, cannot but increase the frequency and severity of the fits of "child-crowing;" and, on the other hand, the violent struggles to recover the breath in the laryngismus stridulus cannot fail to worry parts, which, from inflammation or disorganization, are already in a state of morbid excitement.

In one case, related by Dr. Clarke, there was reason to suspect that the crowing inspiration was occasioned, at least indirectly, by suppurative inflammation of the pericardium, of which, however, it is not a common symptom, certainly not occurring once in twenty cases of pericarditis. This is one of the causes, existing within the chest, upon which the stethoscope should be expected to throw some light. But as I have never had an opportunity of seeing an instance in which I suspected the combination during life, or detected it after death; and as it has not been seen, as far as I know, by any other observer or writer, I am entitled to believe that it must be extremely unfrequent. Still, where it does occur, (and, in the absence of evidence of all other causes, our attention should be directed to this,) it is probably an irremediable disease, and, therefore, renders the compound malady necessarily mortal.

But this laryngeal affection may be associated with other maladies; Dr. Marsh thought this accidental circumstance of such moment, that he has founded upon it his arrangement of the several varieties of this disease; and the affections, with which he describes it as most frequently complicated, are painful dentition, derangement of the digestive function, a cachectic state of the system induced by an impure atmosphere,

occasionally effusion into the ventricles of the brain,⁴ and, lastly, remittent fever.⁵ As to the influence which these occurrences should have in modifying the prognosis, the subject need not detain us long. Painful dentition I have shown to be a cause of the disease, and have spoken of it as connected with the prognosis; derangement of the digestive function may be a sign that the *chorda ventriculi* is affected, in consequence of which the disease is more serious, as it has a necessary tendency, by defective nourishment, still further to weaken the individual; a cachectic state of the system is probably neither more nor less than the "strumous diathesis" with which Dr. Marsh believes the connexion of the laryngismus to be universal, and of which I have said enough; effusion into the ventricles of the brain is just the result of the meningitis or cerebritis, to which I have before adverted; and remittent fever shows that the undigested food has produced, already, morbid excitement of the mucous membrane of the alimentary canal, and, through the ganglionic system, constitutional febrile disturbance, which will aggravate the weakness or cause cerebral congestion, and, thus, in either way greatly enhance the danger.

Frequently as this complaint is connected with a strumous habit, and directly dependant upon glandular enlargement in one part of the body, we can hardly feel surprise that, occasionally, other glands are affected, and, accordingly, it is not uncommon to find those of the mesentery much diseased. This was noticed by Dr. Clarke in one case, and in three instances which I have myself examined, I have found this pathological condition to a considerable extent, marking still further the character of the ailment and, where it occurs, increasing the danger, and, therefore, rendering the prognosis much more unfavourable.

⁴ Dublin Hosp. Rep., vol. v. p. 602.

⁵ Ibid., pp. 607, 611.

CHAPTER VI.

TREATMENT OF THE DISEASE.

A most important part of my subject remains for investigation, namely, the treatment of this complaint. To this, indeed, all the other considerations are but subservient; for, although pathological inquiries are not without intrinsic interest, they have a double value when they develop important medical principles, or lead to such practical conclusions as are calculated to increase our power in the control of disease.

The account of remedies for this disease to be found in the ordinary sources of information upon children's ailments, although meagre, has yet been diffuse from the want of some associating principle by which they might be linked together. The remedial means have been, indeed, rather enumerated, than arranged or explained; and they have been either suggested by some vague analogy, or sanctioned, merely, by downright empiricism. It was, for instance, little better than a loose analogy, which led to the association of this complaint with others alleged to be spasmodic or convulsive, and to the consequent employment of assafoetida and other agents of supposed antispasmodic virtue for its cure. It was, also, a strained and inconclusive application of analogical reasoning, which led to the dogma of the universal dependance of this disease upon vascular turgescence, excitement, or pressure within the cranium, as well as to the pernicious, because indiscriminate, practice of excessive depletion with the administration of enormous doses of calomel, from which formidable, and, too often, irretrievable mischief has resulted. It was mere empirical ob-

servation, that traced the alliance, believed to be direct but in reality very indirect, of this malady with painful or difficult dentition, and led to the advantageous employment of the gum-lance; and it was equally empiricism, which gave the principal sanction to the use of soda, burnt sponge, aperients, and to the recommendation of change of air, which are neither useless nor even ambiguous remedies.

The preceding conclusions with regard to the nature of this complaint, founded, as they are, upon anatomical demonstrations, physiological experiments and inductions, and pathological observations, are calculated to unravel much of this intricacy and confusion, and to clear up much of the obscurity connected with its treatment. It has been seen that the connexion between this complaint, as the effect, and enlargement of the cervical or thoracic absorbent glands, as its cause, is one of great frequency and intimacy; and that the evidence of this essential connexion derives material confirmation from the fact, that the exciting causes of this peculiar malady are precisely those which, according to the best authorities upon such subjects, are constantly producing enlargement of these very glands.¹

In the treatment, therefore, of this complaint, it should be a primary object to ascertain if these glands are enlarged, and tracing, if possible, the producing cause of such enlargement,

¹ Since the foregoing pages were in the hands of the printer several respectable practitioners, having their attention more particularly directed to this disease by my communications to the Medical Gazette, have observed a similar connexion in the living, or discovered it after death. Amongst these I cannot omit to notice Mr. Harvey, of Great Queen-street, Lincoln's Inn, who has seen much of this complaint amongst the wretched inmates of the squalid habitations in the vicinity of Drury-lane; who found in no less than four consecutive instances of fatal termination the same pathological appearances—enlargement of the cervical or thoracic absorbent glands; and who has very obligingly presented to me a large mass which was removed by him from the chest of one of his patients, and which constitutes the subject of the fifth plate at the end of the volume. My friend Mr. North has also informed me, that he has recently met with this disease in three members of the same family, in each of which the whole chain of cervical glands was much enlarged. It is, I have reason to believe, his purpose to communicate these cases to the professional public in the pages of a periodical journal. Mr. Samwell, too, surgeon to the Mary-le-bone Dispensary, has recently traced the same pathological connexion.

to adapt our remedial measures to that cause. Nor must we, simply from difficulty in detecting its existence during life, conclude that there is in reality no such pathological condition. Tumid glands may, as has been already shown, escape detection, even when seated in the neck; whilst, if situated within the thorax, they are always beyond the reach of our external senses. But, as similar diseased conditions commonly produce the same or similar results, we infer from the occurrence of the latter the existence of the former. It is thus, that we determine as to the existence of phrenitis, pneumonia, pleuritis, laryngitis, and other maladies beyond the reach of sight and touch; it is this mode of reasoning which, being amongst the elementary principles of medical logic, constitutes the foundation of most of our pathological conclusions and practical inferences. When, therefore, in certain complaints not necessarily productive of the croup-like inspiration, we find the two co-existing, and more especially if such complaints are notoriously apt to produce or to be accompanied by enlargement of the glands of the absorbents of the neck or thorax, we shall, probably, rarely err if we adopt the conclusion, from the coincidence of the laryngeal affection, that there is in reality concurrent intumescence of the glands. Thus, it has been already stated that painful dentition may occur to the extent of producing great disorder of the bowels, febrile excitement, or even violent general convulsions; discharges from excoriations behind the ears, or eruptions upon the face and scalp may be abundantly, acrid and irritating, and even attended with great surrounding inflammation; vascular congestion and excitement leading, perhaps, to inflammation of the membranes, substance, or serous cavities of the brain may produce general, and even fatal convulsions; effusion may take place within the lateral ventricles until the cerebral substance shall be reduced to a mere shell including fluid, or, together with the membranes, burst from the enormous distention;² scrofula may commit its ravages upon the eye or its membranes, the mesenteric glands, the joints, the lungs, the pericardium, and even within the cranium; and yet all these states of disease

² Baron in *Med. Chir. Tr.* vol. vii. p. 51.

may pursue a lengthened course, from their commencement to their termination either in recovery or death, without a single attack of the croup-like inspiration, and this, merely, because they are not attended with the requisite glandular enlargement;—whilst from coincident disease of the glands of the neck or thorax, we shall occasionally find the milder forms of the same complaints accompanied by the laryngeal affection even in a severe and dangerous degree, and it must be our endeavour, in such cases, to obviate, to palliate, or to remove the cause of such contemporaneous glandular disease.

But the pathological condition of these glands only establishes the liability to the attacks; the paroxysms generally require for their production the intermediate agency of some other event which is to be considered as their exciting cause, just as happens in another formidable malady, the angina pectoris, in which both the respiratory function and the action of the heart are temporarily suspended, and in which, though commonly depending upon structural disease of the coronary arteries which is a permanent morbid condition, some additional physical or moral agency is generally required to produce a paroxysm.³ It is, therefore, a second, but far from secondary point in the treatment of the laryngismus stridulus to distinguish, and to prevent or counteract the operation of these causes of the paroxysms.

As, moreover, the attack has been in some instances suddenly fatal by producing suffocation, the patient can never be considered as quite free from hazard, and it is necessary, therefore, so to treat each paroxysm as to shorten, as much as possible, its duration. This more particularly requires attention in those instances in which the breathing is completely suspended, for the restoration of which it is sufficient to procure, if practicable, even that imperfect inspiration which the crowing

³ In the case of an illustrious surgeon who fell a victim to the disease, “the first attack was produced by an affection of the mind, and every future return of any consequence arose from the same cause; and, although bodily exercise or distention of the stomach brought on slighter affections, it still required the mind to be affected to render them severe.”—*Life of John Hunter*, by Sir E. Home:

sound implies ; for by this is insured, at least, the temporary safety of the child.

These are the three leading principles of treatment, and under one or other of these "indications of cure," as they are technically called, all our remedies may be arranged and considered.

The several causes of this malady, the agency of which I have noticed and explained, may act either singly or in concurrence and combination. In the former case the treatment of the disease is generally more simple and efficient ; but in the latter, as their co-operation produces a combined or cumulative effect, the complaint is more obstinate, and the remedies at once more complex and more uncertain in their effects. Each cause will, therefore, require a separate consideration, and in estimating the extent to which each should modify our treatment I shall pursue the same order of arrangement, as that which I adopted when noticing their influence in producing the disease.

Age.—Amongst the predisposing causes were enumerated age and hereditary or acquired constitutional peculiarity. The first of these causes, however, is altogether beyond our control ; but if there be any disposition to this malady, double caution is requisite, from the very earliest period of life, to avoid all those causes which have a tendency to produce it.

Constitutional peculiarity.—The disposition to this disease is often a family peculiarity. I have known many instances and have adduced several striking illustrations of it. This family propensity, however, is but a state of constitution which predisposes to the disease, and although children may have it from hereditary descent and in common with other members of the same family, yet it may be occasionally generated by the untoward agency of external circumstances ; and, as some of these are much under our control, the predisposition, whether original or acquired, may be diminished or counteracted by obviating the injurious tendency of these accessory causes, amongst which not the least influential are the accidents of climate, situation, and season.

Climate, situation, and season.—It has been seen that this

disease, whilst it is not very frequent in dry and elevated, though cold situations, is yet far from uncommon in low marshy situations, though the climate, as in Piedmont and the south of France, may be warm; it is infinitely more frequent in crowded cities and large manufacturing towns than in the country; amongst those whom the *res angusta domi* confines to an apartment in the basement story or the higher region of the attics, than amongst the children of those who inhabit the intermediate parts of the same house; and, lastly, it appears to be much more prevalent in winter and the early part of the spring than in summer and autumn; more especially in a mild and open winter, like that of 1833-4, when it fell to my lot, as well as to that of many of my professional friends, to see more of this disease than during any one of many preceding years.

With a view, therefore, to the prevention of this complaint where there is a decided proneness to its occurrence, it is essential to attend to these circumstances, the operation of which is manifest. The children of parents, whose occupations confine them to marshy districts, should be sent, if possible, to some more dry and healthy situation, especially in such seasons as that described by Millar,—“in the autumn, after the summer of 1755, when a great quantity of rain fell, the harvest was wet and late, the crop scanty, and the grain much damaged.” The inhabitants of large cities or manufacturing towns should, if it can be accomplished, send their child into the country, or, this being beyond the means, or inconsistent with the arrangements of the parents, the room in which the child spends the greater part of its time should be equally removed from the dampness of the basement story—involving probably exposure to the pestilential effluvia of imperfect drains—and from the pernicious agency of the alternate heats and chills of day and night, and of the sudden vicissitudes of temperature which a child must encounter in a chamber immediately under the roof. Amongst the poorer classes of society a slight difference of expense will secure a room intermediate between these extremes; and the more affluent must be peremptorily enjoined to sacrifice some of their little conveniences to the preservation of their children,

by devoting to their nursery arrangements a room or rooms less obnoxious to the prejudicial influence of these sudden changes.

Dress.—Upon the same general principle the dress of the child requires attention. Warm clothing is all-important. A fashion has recently grown up amongst us of dressing children like our barbarian ancestors; but without the protection of paint. Their clothing does little more than cover their waists and thighs. The neck and chest are bare, the arms exposed from the point of the shoulder downwards, and the legs and knees uncovered. The skin of those children, who are peculiarly the subjects of this disease, is greatly sensitive to the impressions of cold; they require, therefore, generally through the cold season the protection of fine flannel, in which they should be clothed from the neck to the wrists, the legs being also covered with woollen stockings. Let not the professional attendant hesitate, under such circumstances, to oppose himself to this pernicious custom, or be discouraged by a few instances of failure in the attempt. He may, indeed, in this, as in many other points connected with the general management of the nursery, find much from which he may dissent, and yet be unable to control; but it is still his duty to interfere.

Since, also, in damp weather and situations this complaint is particularly apt to occur or to become aggravated, children who have any liability to this disease should, during fogs, and rain, and, perhaps, even when the wind is excessively keen, though dry, be confined to the house, where they should have free access to, and be exercised in the most airy apartments; but in dry and temperate weather they ought not to be debarred from exercise in the open air. Nor need we be deterred in these cases by the mucous *râle* so frequently observed in this disease; for this will not be increased by moderate exposure. There is, in these cases, no inflammation to be aggravated, and no morbidly sensitive membrane to be irritated by the entrance to the air passages of an atmosphere cooler than that of the house. There is, probably, not even any increase of secretion to be checked; “the sound, as of mucus,” being simply the result of accumulation of the ordinary secretion of

the part ; in an increased quantity, however, in consequence of defective power of the expelling apparatus, which is at least enfeebled, if not paralysed :—and upon this condition weather has little other effect, than as it has a tendency to enlarge or to diminish the glandular tumours, upon the indirect influence of which that accumulation depends.

Analogous in principle is the habitual use of the warm or tepid bath, which is often agreeable to the feelings of the child and, in such case, a valuable auxiliary in the medical treatment. It equalises the distribution of blood, solicits its flow towards the surface, and produces tranquil sleep. When, therefore, the circulation appears languid, the surface is cold and sunken, the extremities chilled, and, more especially, when there is in the appearance of the elbows, hands, and feet an approach even to chilblain, this remedy, followed by rapid friction with a coarsish towel, may be beneficially employed. But if the child betray an insuperable aversion from its use, if it struggle and cry violently, then, for reasons which I am immediately to explain, it must not be persisted in.

Some, again, with a view to increase the strength which is commonly defective, and by the reaction, as it has been technically termed, to give vigour and increased activity to the circulation in the extremities and upon the surface, have suggested a trial of the cold bath. But I have already stated that strong impressions of cold upon the skin—very ill borne by these children—are generally painful and injurious ; and even their mental influence is very far from beneficial. Children have, commonly, a great terror of a plunging bath ; and it is well known that fear or sudden fright, especially if it lead to violent crying, is amongst the most frequent occasional causes of a paroxysm ; an observation which applies as well to the warm or tepid, as to the cold bath. In one instance the first attack of laryngismus stridulus commenced with a gasp brought on by the sudden application of cold water to the head in washing ; and this is abundantly intelligible. Many, even in adult age and in health, experience embarrassment of breathing with great sense of oppression in the chest and even, sometimes, a sort of sobbing—hurried inspirations inter-

rupted by distinct, though brief constrictions of the glottis—upon plunging into cold water; and such constriction is of the essence of this malady. Whatever, therefore, has a tendency to excite, to aggravate, or to reproduce such constriction cannot fail to be detrimental in this ailment; and for these reasons the cold bath should be discountenanced. When, however, there is merely that general proneness to this malady which is engendered by a scrofulous diathesis, it is said that sea bathing may be useful; but, although the tepid sea water bath or the shower bath even cold may be, occasionally, advisable to give tone and vigour to the system, I have been disappointed, even in such cases, by my trials of the cold plunging bath, though tried in favourable weather and in the open sea.

Diet.—The regulation of the diet is of the greatest moment with a view, in every child, to obviate a disposition to this, amongst other diseases, but, especially, where there is a family propensity to its occurrence; and the earlier the period at which this important branch of the physical education of infants is attended to, the better. To begin *ab ovo*, the propriety of rearing such children exclusively at the breast must be insisted on. The chances of preserving children, who have a family proneness to this complaint, will be exceedingly slight if it be attempted to bring them up by hand. The mother, if she be healthy, willing, and competent to the task, is, unquestionably, the most proper person to nurse her own offspring:—but if she be feeble or unhealthy; if she exhibit in her own appearance and history the evidences of a strumous habit; if she dislike the office, or, a slave to fashion, is indisposed to encounter those demands upon her time and attention, or to submit to those privations of the pleasures or rather dissipations of society, which a due performance of this maternal duty implies; if she be unfit for the office in consequence of some defect, either of quantity or quality, in her supply of milk; and if, lastly, with every attention to her duty to her child, she has still lost several in succession from this complaint; it were better, then, that she should altogether relinquish the attempt. The system of half-nursing, now far

too prevalent, cannot fail in all cases, but especially where there is any tendency to this disease, to tantalize the child with very disproportionate advantage. Its only recommendations are, that it is, upon the whole, less expensive than a wet-nurse ; is, perhaps, just a little and but little better for the child than the exclusive employment of artificial food ; and, what constitutes no unimportant element in the calculations and decisions of many, it may tend to diminish the frequency with which, under other circumstances, the mother might bear children. The plan, however, like half-measures in general, will satisfy neither party. The mother—perhaps already feeble—whose supply is scanty will suffer from additional weakness, and her milk, consequently, will become gradually less and less in quantity and, afterwards, deteriorated in quality ; whilst the child will be defectively nourished, the functions of its digestive organs impaired, and the foundation laid for the laryngismus amongst other maladies.

In all cases, therefore, of constitutional tendency to this complaint, where the mother is unequal to the task of suckling or unwilling to undertake it, a healthy wet-nurse should be provided ; and the regulation of her diet is essential. Candidates for such situations would be little disposed to relinquish the care of their own offspring, but from an overwhelming necessity. Coming, however, to a house where they have a well-stored larder at their command, they are, from a mistaken kindness, often allowed to indulge to the full extent of their inclination. Such sudden change of diet, at all times injudicious, is under the present circumstances peculiarly injurious to both parties ; depriving the wet-nurse of her situation, and the child of healthful nourishment. A state of feverish excitement is induced, which injuriously affects the quality and, ultimately, diminishes the quantity of milk ; thus distressing the child in the first instance, and nourishing it imperfectly afterwards. Besides, these children are generally weakly, and their digestive powers are enfeebled in a corresponding degree. They will not, therefore, bear the same extent of aliment or milk of such nutritive properties, as other children will digest with ease. Great caution is, consequently, requisite so to manage

the diet of the nurse that the milk, in quantity and quality, shall be proportionable to the exigencies of the child and its ability to digest it. But it would occupy too much space to enter minutely upon the subject of the regulation of the diet of wet-nurses. The general principles are tolerably understood and attended to; but the *gradual* improvement, requisite where they come from the miserable habitations and impoverished diet of indigence, is a point which is too frequently overlooked.

If the nurse be healthy and well supplied with milk, there can be no necessity for, and no advantage from cramming the child with artificial food; and the length of time, that the child should live exclusively on the breast, will be determined principally by the appearance of the teeth. I should be unwilling to take the child from its natural food, until nature indicates the propriety of a change by the escape from the gums of at least four, probably all of the incisor teeth. The period, at which this may happen, varies much in individual instances. Some infants, it is well known, have been born with teeth; others have the incisors before the completion of the fourth month; whilst others, especially pallid exsanguineous children of feeble and torpid habits, may be twelve or fourteen months without a tooth. Although, therefore, this early or late appearance of the teeth may, to a certain extent, modify our decision with regard to the length of time that a given child should live entirely upon the breast, yet it is a good general rule to persist in this more natural mode of rearing, upon an average, at least ten months; and in those languid habits which are particularly liable to this disease, and in which the appearance of the teeth is late and very apt to be attended with disturbance of many important functions, it is better to act upon the safe side, and to continue this simple unirritating diet for a longer period than usual, rather than to be precipitate in our determination to wean.

The illustrations of the evil consequences of attempting to bring up such children by hand are almost endless. One example may suffice. A lady lost her first child from this complaint; the

bronchial glands, two of which had undergone the imperfect suppuration of a curd-like character so strongly indicative of an unhealthy constitution, were greatly enlarged. Her second child, although suckled by a healthy wet-nurse, had been more than once attacked in London, but recovered upon being taken into the country with its nurse. This lady has since been confined, in one of the inland counties, of a third child, which, over-persuaded by her husband's family with whom she was then residing, she attempted to bring up by hand; but although at birth a fine child, with all the advantage of exposure to an unpolluted atmosphere, in a commodious, well-aired, well-warmed, well-ventilated country mansion, with every convenience and comfort which affluence could procure, under the vigilant superintendence, too, of a very respectable medical attendant, and in the same place as that which appeared to preserve her second child, it still survived but a short time, and is said to have died in a fit. The same thing will sometimes happen from weaning too early or, perhaps, too abruptly, of which numerous examples have presented themselves to my notice; but it is needless to multiply instances in proof of a proposition, which is all but self-evident, that the more we deviate from nature in the mode of feeding any, but particularly feeble and delicate children, the less the probability of our preserving them from this, amongst the many maladies to which they may be constitutionally prone.

But some mothers, unwilling or unable to suckle their own children, still persist in their refusal to intrust them to a wet-nurse; others may be unable to encounter the expense; upon some occasions it may be impracticable to procure one with the requisite qualifications; and in some rare instances, especially where the child has been already fed artificially, in spite of the most judicious attempts to conquer the aversion it obstinately refuses to take the breast. Under such unfavourable circumstances there is no alternative. We are reduced to the absolute and uncontrollable necessity of, at least, attempting to bring up the child by hand, which is, at best, but a hazardous expedient. In much more than a

numerical majority even of the most healthy children the attempt will fail. Dr. Clarke, indeed, after candidly admitting that "some, who are so treated, live and are strong," adds, in strong and emphatic terms, "for one such instance, however, ten might be produced of children who die under the experiment; but the grave tells no tales." I should have been disposed to consider this as the exaggeration of an enthusiastic mind, had it not been confirmed by the observation of Dr. Merriman that "the attempt to bring up children by hand proves fatal in *London*, to at least seven out of eight of these miserable sufferers; and this happens whether the child has never taken the breast at all, or, having been suckled for three or four weeks only, is then weaned. *In the country*, the mortality among dry-nursed children is not quite so great as in *London*; but it is abundantly greater than is generally imagined." Making, however, every allowance for the possibility of these statements being somewhat overcharged, there will still remain a fearful balance against dry-nursing, the extent of mortality from which varies, according to my own observations and the opinions of different practitioners, from three-fourths to four-fifths. But, if this mortality be so great, as applied to the bulk of the community, it must be much greater, approaching probably to the calculations of Merriman and Clarke of from seven out of eight to ten out of eleven amongst those, whose proneness to this complaint proclaims a delicacy of constitution, which will render their condition, in the language of the insurance offices, "doubly hazardous." Still, where the insuperable difficulties, to which I have adverted, present themselves, we must make the attempt; and we must have recourse to such modes of feeding, as are the least remote from those which nature adopts, both in the quality and quantity of children's food, and in the frequency and mode of giving them their meals. In regulating all this, we shall have much to control in the prejudices and practices of nurses, who, too frequently, seem to look upon the operations of nature as a beacon to warn them, rather than as a guide to direct them;—"they imitate nature so abominably."

IN QUALITY, the food, which nature supplies, is perfectly

fluid, thin, sweetish, and in its nutritive properties duly adjusted to the power of the digestive organs. But, even in this first essential point of quality nurses constantly err, stuffing the children under their care with gruel of extravagant thickness, made either of grits, oatmeal, barley, or rice, all of which, as well as flour, arrow-root or, indeed, any farinaceous food, will, unless duly digested, deposit a powdery mass within the intestinal tube. This obstructs the secreting vessels, worries the muscular apparatus, and, as a remote consequence, irritates the mucous lining; giving rise to a formidable train of evils, as constipation, colic, invagination of a portion of intestine, disordered secretions, remittent fever of children, lientery or watery gripes, "gastro-enterite," follicular ulceration, and marasmus or tabes mesenterica.

That which approaches nearest to the food provided by nature, is asses' milk. It has the thinness, sweetness, and little disposition to coagulate of human milk; and this, therefore, where it can be procured, should be preferred. But it is expensive in large towns, often difficult to be obtained in the country, and is, consequently, not within the reach of all. Cow's milk must in such cases be substituted; but, to assimilate its properties to those of asses or of human milk, it must be diluted with about one-third of water, or what is, perhaps, more nutritive and easier of digestion, with about two-thirds of gruel, which, according to Dr. Clarke, "diminishes its disposition to coagulate and renders the coagulum, when formed within the stomach, less firm and indigestible." London milk, however, is already much diluted, and, commonly, robbed of its cream. It may be advisable, therefore, in this metropolis to use the milk in the proportion of one-half,—making the gruel somewhat thicker,—to sweeten it with sugar till it resembles in flavour human milk, and to add to each meal from one to two tea-spoonfuls of cream.⁴

⁴ We are assured by a recent writer that "one part of fresh cream with four or six of water and a little sugar, is the best substitute for mother's milk," and this is recommended with apparently the most complete confidence in its propriety. But there are, I should apprehend, few stomachs, even of adults, that would bear this quantity of cream, which, in the ordinary meal of a small tea-

Some advise that the milk should be boiled, even two or three times, to separate the albuminous crust which then forms and floats upon the surface, and which is thought to be more indigestible than even the curd. The necessity, however, for this is questionable; for it is probable that this albumen does not exist uncombined, as a proximate principle of the milk from which it is separated, but appears as the result of the chemical agency of excessive heat. Were it otherwise, one boiling would certainly separate the whole.

Other alimentary materials are not unfrequently employed either as substitutes for, or in conjunction with milk; and I have already alluded to the opinion of Dr. Clarke that cow's milk is less indigestible if mixed with "gruel made from pearl barley, grits, rice, or arrowroot, than when diluted with water alone." The advantage, however, of this plan arises probably from our being able to use a less quantity of milk, rather than from any peculiar influence which these substances exert in preventing coagulation. The gruel being itself nutritive, we can dispense with one-half of the relative quantity of milk, which may be reduced to a third, or even a fourth of the whole. "When so mixed, it does not become hard in the stomach, as when diluted with water alone, but forms a thick fluid." There is a preparation, also, sold in the shops, called "prepared barley," which agrees tolerably well in ordinary cases, whilst some, again, prefer the "farinaceous food for infants," others, the finer kinds of bread, as rusks, tops and bottoms, biscuit powder, or biscuits prepared on purpose; others, baked flour rasped, boiled with water, and then mixed with the due proportion of milk and sugar. Upon the whole, however, where the child has not a wet nurse and asses' milk cannot be procured, I prefer simple grit gruel in combination with the due proportion of milk and sugar; but if, upon ex-

cupful, would amount to from one table-spoonful to one-and-a-half. It is, however, only in the proportion recommended, that there is any novelty in this suggestion; for Clarke had before stated that "with some children no form, in which cow's milk can be given, will agree; but the stomach will digest farinaceous decoctions, *mixed with a little cream*, which will not coagulate then." Burns also recommends one-sixth of cream in some cases; but, surely, this is too much. There are few who would bear so large a quantity.

periment, this is found to disagree, the other substances above enumerated may be tried in succession, varying them according to the condition of the bowels; the grit or barley gruel, prepared barley, and "farinaceous food" being more aperient, than arrowroot, biscuit powder or any other kind even of the finest bread, flour, or rice. If, therefore, there be a tendency to constipation, the food should be selected from the former list of alimentary materials; if to diarrhœa, some of the latter should be chosen.

Some children will not bear sugar in any form, as was the case with an infant, long under my care, in Hanover Terrace, Regent's Park. This child never throve, and became, at length, so fearfully extenuated that I had the greatest apprehensions for its safety. In this state it was sent to Brighton, where nothing seemed to agree with it, until Mr. Dill, under whose care it was placed, directed that, as an experiment, sugar should be altogether relinquished, and salt substituted in its gruel. From this time the child rallied, and is now one of the most lively, active, and healthful of a very fine family of children.

As to the QUANTITY of food which should be taken at each meal, I incline to the belief that if a child in health were left to its own inclination and appetite, rather than to the discretion of the nurse, it would rarely err to any great extent. No particular regulation of the quantity of the mother's milk appears necessary, and there is no sufficient evidence of the necessity of greater restrictions when the child is fed from any other sucking apparatus. Nurses, however, and many parents, fancying that a child can cry from no other cause than because it is hungry, apply under such circumstances the nipple or sucking-bottle to its mouth until, by their importunities amounting to positive teasing, the child sucks as the lesser evil. It may desist from time to time; it may again and again withdraw its mouth, screaming from annoyance; but a blundering nurse, misunderstanding or neglecting the hint, persists in cramming the mouth with food, until the child, having only the alternative of swallowing or suffocating, (for the rejection from the mouth of that which it

may contain, is impracticable whilst any mechanical substance keeps the lips and gums permanently open,) gulps it against its inclination in preference to being choked.

This disposition to ply the child constantly with food is, often, but an apology for idleness, the attendant having recourse to it as a solace and amusement to the child upon all occasions, and, too commonly, to the exclusion of that healthful exercise which a judicious and active nurse will give, and which alike promotes the appetite, and invigorates digestion. Parents, however who are young and, consequently, inexperienced, and who yet feel that they cannot rely upon the attendants in their nurseries, often expect the medical attendant to give specific instructions as to the quantity of food which should be given to a child at a meal. But it must be with children as with adults, that they vary in the extent of their appetite and the vigour of their digestive powers; and each child, therefore, may require a different quantity. Much, then, must after all be left to the discretion of the nurse; but it will be a good general rule, when the child withdraws its mouth either from the nipple or the bottle and shows little disposition to resume its work when once solicited by the nurse, to conclude that it has taken as much as its constitution demands or its appetite inclines to; and no means should, after this, be adopted to force it against its desires. In some instances, either from habit,—more rarely from inclination,—a child, whether at the breast or fed by the sucking bottle, will gorge itself until its stomach, incapable of holding more, rejects the superfluity by an action more allied to regurgitation than vomiting, being without that peculiar effort called retching. The œsophagus, acting in this case as a sort of waste-pipe, shows that the containing vessel is full to repletion. The stomach being thus relieved, the nurse will sometimes again present the breast or the bottle, and the child will take that which is offered, until it presents the same unequivocal evidence of repletion. This can only be rectified, with a child at the breast, by observing how long it can suck vigorously without the occurrence of this kind of vomiting, and at what time this partial rejection of

food takes place ; and, then, by shortening the period of suckling, until it is found that this disposition to throw up a part of its meal ceases:—or, if the child be brought up by hand, a similar regulation as to quantity should be enforced, gradually diminishing the extent of each meal until the evil disappears.

But although the precise quantity of each meal cannot be defined with accuracy in individual instances, there is still an average quantity which will agree with the majority of children, and it will be at least an approximation to the truth to estimate this at a tea-cup full or about four ounces for an infant under six months of age, extending it gradually to six or, at the utmost, eight ounces, as the child advances towards ten or twelve months of age.

The FREQUENCY with which children should be fed is also an object of great moment. At a very early period after the birth the child is constantly put to the breast, as a remedy for the sufferings which the mother endures from over distension ; and as the milk is, at this time, more or less aperient, and the bowels, therefore, become an outlet for any superfluous quantity, the infant will probably suffer nothing. Such practice, however, cannot be continued long with impunity. After the first week the child should not be taken to the mother oftener than every two or, what is still better, every three hours ; and an intelligent nurse will speedily teach the child, after having been taken to the mother late at night, to sleep, with one interruption only, until an early hour in the morning. Had I not repeatedly noticed the absurdity of an opposite practice, I should have deemed it a work of little better than supererogation to inculcate a precept so obvious, as that a child should never be awakened for the purpose of giving it food. Some may think, perhaps, that there should be an exception to this rule, if it be suspected that sleep has been induced by narcotics—a practice still unfortunately too prevalent amongst nurses ; but, after all, this is rather an argument for changing the nurse, than for awakening the child. I have known a child at the breast sleep for above thirty hours in consequence of the external application of opium ; and, during the whole of that time, it was only once imperfectly awakened to take, in

a drowsy half torpid condition, a little milk from the mother's breast. It at length, however, recovered from the torpor, was free from the cough for which the opium had been rubbed upon the skin, (none having been given internally) and then took and digested its food as before. It is probable that if the mother had persisted in forcing any ordinary aliment upon this child, whilst under the influence of the narcotic, the stomach, partaking of the general torpor, would have refused its office, and the food, if not rejected, would have proved a source of irritation and consequent mischief.

Lastly, the *MODE* in which a child gets its food is well worthy of consideration. In the natural method of feeding the child draws in its food drop by drop or in very slender thread-like streams, and by an effort of its own. This stimulates the salivary glands to an increase of secretion, just when an additional quantity of saliva is required. What may be the precise use of this secreted fluid, whether it is a mere diluent, a solvent, or a peculiar ferment, is not yet definitively determined; but it is sufficient, to establish its utility in digestion, that nature supplies it from several sources instead of one, and that the quantity is increased not only upon taking food, but even in anticipation; for it is literally, as well as figuratively, true that "the mouth waters" at the smell of savoury viands; but it is still further augmented by suction in the infant,—by mastication in the adult. Nurses, however, think that they can manage this matter better, and with less expense of time and trouble. Having prepared a child's food, they pour it from a pap-spoon or a boat (for nothing less than a boat will satisfy some) at once into its mouth, without any voluntary effort of its own, without therefore the due admixture with saliva, and, often, in direct opposition to its wishes; the nurse appearing to think the child cannot have too much of a good thing.

The sucking bottle is, upon the whole, the best substitute for the breast, and the want of a natural nipple may be supplied either by a prepared cow's teat deprived of its ducts, its cellular texture, and erectile tissue, or by vellum, parchment, or chamois leather; all of which are in common use. If the teat be

employed, the manufacturer leaves a sufficient aperture; but if any of the latter substances be used, they must be cut, in shape, like the finger of a glove, and sown closely at the sides, leaving, however, long stitches or piercing several holes at the extremity, and placing in its interior a small piece of very porous sponge. For want of attention to this mode of preparing the artificial nipple, I have repeatedly seen a half-famished child sucking ineffectually at what was equivalent to the close-stitched extremity of a kid glove, or squeezing the sides together so firmly with its lips as to prevent the possibility of the smallest portion of fluid passing.

But these artificial nipples imperiously demand the utmost attention to cleanliness and frequent renewal, otherwise they are apt to become sour and then to leaven, as it were, all the food that passes through them; for the smallest quantity of a substance undergoing the acetous fermentation will occasion a similar change in even a large mass of any fluid prone, like the food of a child, to run into the same kind of fermentation. If these nipples be placed in spirit of any kind for their preservation, they are apt, unless previously effectually washed, to irritate, when used, the mucous membrane of the child's mouth, and so to occasion thrush. To obviate these inconveniences I have of late been much in the habit of substituting a silver nipple nicely adjusted in form and size to the shape of the lips; and this, when the child has from its birth been brought up by hand, I have rarely known it reject. It is more cleanly; the apertures constitute a test of the proper preparation of the food; and in travelling, or upon a voyage, it will be found particularly useful. Children, however, very speedily distinguish any change in the mode of management to which they have been accustomed, even to the exchange of one nipple for another and to the method of handling them in nursing; and it is, therefore, abundantly intelligible that their sensitive lips will immediately recognise, if they have been accustomed to vellum or the teat, the change to a metallic substance, which is now for the first time put into their mouth, and which differing in essential physical properties from that substance with which they have heretofore associ-

ated the idea of food, recalls to their minds no pleasurable sensations or emotions; they may, therefore, reject it for a while, and even scream when the nurse persists in putting it to the mouth. The advantages, however, from the silver nipple being considerable, the attempt to use it should not be immediately relinquished; a little patience and assiduity will commonly overcome the child's aversion from this new contrivance, and the difficulty, once encountered and subdued, rarely recurs. This mode of feeding, moreover, whether through the cow's teat, the vellum, or a silver nipple, secures another important object, namely, that the child when satisfied can desist, which it is constantly prevented from doing when fed in the common way from the spoon or boat. I need scarcely add that it is intended by the regulation of the diet at this tender age to keep the child in the best possible state of health, with a view to prevent, rather than cure, disease. Further rules will doubtless be required when this peculiar malady is established, and according to the advance in age of the child.

But, under the most judicious management, only a small proportion, as I have already stated, will be preserved where there is any tendency to this complaint, and the utmost watchfulness is therefore required to detect and intercept even the approaches of disease. Under such circumstances of artificial rearing, illness when it is established, although insidious in its earliest advances, is apt to run a fearfully rapid course to its unfavourable termination.

*Principiis obsta; sero medicina paratur
Cum mala per longas invaluere moras.*

There are few conditions in which this maxim, trite but true, is more applicable than in such cases. We must, therefore, constantly interrogate nature through the condition of the functions of the child, that we may ascertain the state of health, obviate disease in its approach, distinguish its existence and character, and check, if practicable, by the prompt application of remedies its impetuous career. It is thus alone that, in the absence of speech, we can investigate the ailments of children; but it is a mode of physical expression which, being little under disguise and liable neither to the exaggerations of the

hypochondriac or morbidly sensitive, nor to the extenuation of those who fear the visits, the restrictions, or the doses of the doctor, is perhaps as little liable to misconception as even the articulate language of the adult. This method of inquiry has been well noticed and not unduly eulogized by Underwood and others; but particularly by the late Dr. Clarke who says, "It has been argued that the diseases of infant children could not be investigated because they are not capable of describing their complaints, and that a physician, on that account, cannot understand them. This, however, is not altogether true. Their colour, figure, fatness, leanness, paleness, redness, the tone of the skin, the general or local heat or coldness, gestures, cries, brightness or dulness of the eyes, the state of the pupil, the direction of the eyes, the state of the ossification, the straitness or deformity of the skeleton, the tone or atony of the muscular fibres, the state of the abdomen, enlargement of the viscera, the state of the respiration, the various secretions, the excretions, their number, colour, consistence, texture, smell—all these, and many more symptoms of the state of health or disease present themselves to the consideration of an attentive physician, and leave him without an excuse if he neglects a part of his duty in which the feelings of parents and the good of society are so materially concerned, as in the cure of the diseases of children."⁵

Amongst the functions and organs thus enumerated the state of the alimentary canal has peculiar interest, because here will be first manifest the evidence of the injurious consequences of this mode of rearing. Whilst the evacuations continue healthful, there can be no reason for alarm or interference. The appetite being unimpaired and the digestion perfect, (the latter being proved by the appearance and due frequency of the stools, together with the absence of intestinal pain,) the body will be well nourished, the sleep uninterrupted, the spirits cheerful, and the whole child will present a healthful aspect. But the very earliest tokens of disorder require attention. At first, probably, the food will merely pass through the canal undigested; if milk has been the principal article of

⁵ Commentaries on the Diseases of Children, p. 34.

diet, it will appear curdled in the evacuations ; if farinaceous substances especially arrow root, barley, flour, or even bread have been employed, there will appear in the stools a powdery mass, pasty when recently discharged, and when dry easily broken down like baked flower, though cemented by the secretions of the canal and tinged with bile. As yet, however, there may be no disordered secretions. The colour of the evacuations may be good at the time of their expulsion, but, from exposure of the undigested food in its moistened condition to atmospheric influence, it turns sour ; and the acid thus generated, as in the experiment with vinegar upon the colouring matter of bile by Tiedemann and Gmelin,⁶ corroborated by others, tinges after a time the whole mass of a green colour.

The above is, commonly, the first in the series of injurious appearances. Afterwards, the undigested aliment brought in constant contact with the sensitive mucous lining of the canal will irritate its secreting apparatus, and produce slimy, discoloured, offensive discharges from the bowels, not unfrequently tinged or streaked with blood, combined with little if any true feculent matter, and commonly attended with much abdominal pain. Under such circumstances alimentary materials feed disease, but *not* the constitution ; the child screams from attacks of intestinal spasm ; assimilation is defective ; the countenance no longer preserves its roundness and healthy character, nor the limbs their plumpness ; the skin, pale and flabby, hangs loosely upon the extremities ; the muscles lose their firmness and contractile power ; this occurring in the abdominal parietes,—nature's waistband,—they offer little resistance to the distension of the intestinal canal from flatulency, and the infant has that peculiar combination, so constantly observed in ill nourished children, of tumid and tense belly with extenuated limbs. The bones, also, losing their solidity, become twisted from posture, from pressure, or from the action of their own muscles ; and, if there be any constitutional propensity to glandular enlargement, it will next to inevitably occur in those parts in which such morbid condition is particu-

⁶ Recherches sur la digestion. Prem. partie. p. 74.

larly apt to occur, as in the neck or mesentery, and not unfrequently in both.

The removal of these undigested materials and acid contents of the bowels is necessary ; and this must be effected by the mildest possible aperients, as a little castor oil, magnesia, or a little rhubarb and magnesia ; or, where there is not yet any manifest disorder of the secretions, by emollient glysters, which hurry the passage through the intestinal tube of that which, if retained, would prove a source of irritation. These will also soothe the bowels, abundantly prone under these circumstances to excitement, rather than add to the irritation which is too frequently the result of acrid cathartics ; and will thus interrupt the series of evil consequences. Much may also be done by the regulation of the diet, trying the various alimentary substances usually employed for the food of children according to the principles of selection already noticed, until some one kind shall be found to agree. If all kinds of farinaceous substances ferment, distend, or irritate, or if they even pass through undigested, it may be necessary to have recourse to animal substances, as the “hartshorn jelly” so much recommended by Underwood, or the “weak mutton, chicken, or beef broth, clear and free from fat, mixed with an equal measure of mucilaginous or farinaceous decoctions” directed by Clarke ; and there may be instances in which it may be requisite to use these animal decoctions uncombined.

Scrofula.—Upon the confines of the predisposing and exciting causes, sometimes acting as the one, sometimes as the other, is a strumous taint. The influence of this in producing the laryngismus stridulus and its treatment constitute, indeed, a very comprehensive subject, and will require a somewhat detailed consideration. I have already considered the question whether the family propensity to the crowing inspiration does not, after all, resolve itself into a strumous diathesis, and have been disposed to conclude in the affirmative : for the same causes produce both diseases, the two very frequently exist in combination, and the croup-like inspiration is generally directly connected with morbid enlargement of those absorbent glands most likely to be affected by struma. So,

whilst a recent writer⁷ upon the "statistics of surgery" states that "the lamentable effects of scrofula may, in most instances, be traced to the want of ventilation, to insufficient and unwholesome food, to the damp, crazy, and filthy abodes, and to the many wants which poverty engenders and which wealth might remove," we also know that similar causes will produce this laryngeal affection. Hippocrates represents the asthma of children as connected with residence in confined cities where the evaporation is imperfect, with sudden vicissitudes of temperature and with inhabiting the vicinity of marshes or standing pools: Millar describes the asthma as occurring in the autumn after a wet summer, in a district of clay which retained the moisture, and when the harvest was late and much damaged by the wet,—the latter implying defective nourishment: Moss observes that the asthma of infants is most commonly "met with in the children of the poor, who inhabit cellars," "in cheerless situations, which admit of few indulgences," and "now and then in the children of the less needy, when it, no doubt, is occasioned by the same cause, from the negligence or inadvertency of the nurse:" and Marsh alleges that he never saw the so-named "spasm of the glottis" but in children themselves strumous or born of scrofulous parents. Where, therefore, such constitutional taint exists, it is absolutely necessary to bear this in mind in directing the treatment of the laryngismus stridulus.

Notwithstanding the vast variety of means which have been recommended for the cure of this constitutional malady, it still remains "*inter opprobria medicorum*;" nor do I pretend to provide a remedy for a disease, which has baffled the inventive genius and sagacity of practitioners from the earliest ages of medicine, even to our own time. But there are a few leading points connected with the history and management of this formidable malady, with regard to which all medical writers and practitioners are agreed. There is, for instance, no dissonance of opinion as to its connexion with debility, and as to the necessity of having recourse to such means, as are calculated to uphold the constitutional powers without producing

⁷ Mr. J. H. Green, in *Med. Gaz.* v. 17.

excitement. One of my earliest professional teachers, speaking of scrofula, not only represents it as a "miserable title, given to a class of diseases springing from debility," but also that "in its character and origin it is debility;"⁸ and he subsequently adds, "air, exercise, and nourishment are the three great points to be kept in view in the treatment of scrofulous affections,"⁹ the "principles on which the treatment of scrofula should be founded" being, according to this distinguished surgeon, 1st. to make better blood; 2nd. to strengthen the solids; 3rd. to give vigorous action to the circulation.¹ But these indications are similar or identical, and resolve themselves into the more general principle of restoring and sustaining the defective constitutional powers. For this purpose a mild but generous or, at least, nutritive diet should be allowed; but it must be borne in mind that the children liable to this complaint have generally weak digestive organs, which will not convert into nourishment alimentary matters that offend either by their quality or their quantity; and it must be recollected, that it is not what is put into the stomach, but what is digested that gives support and energy to the body. Whatever remains undigested is a source of weakness rather than of strength; and as an enfeebled limb will not bear the same exertion as one that is sound, so a weakened stomach is incapable of acting with vigour upon the same quantity or, perhaps, kind of aliment as in a state of health. These must be regulated according to the age of the patient, and proportioned to the vigour of digestion. But it is impossible for me to enter with any minuteness of detail into the very important and extensive subject of the diet of children after the period of infancy; and I must content myself, therefore, with calling, in a very general way, the attention of the profession to this most essential point, so obvious and familiar as to be too often overlooked or neglected.

Alimentary matters which readily ferment are not the most desirable articles of diet; we are often on this account obliged, even at an earlier age than one would otherwise think of

⁸ Lectures on Surgery, by Sir Astley Cooper, Bart. F.R.S. 12mo. 1832, p. 545.

⁹ Ibid. p. 553.

¹ Ibid. p. 550.

doing it, to substitute strong animal decoctions with vermicelli or rice for the more common kinds of farinaceous food ; and, as in these diseases we constantly find the curd of milk in small masses, and potatoes, altogether undigested, passing through the bowels, we shall be frequently called upon to prevent their being employed as articles of diet. All such trash as sweet cakes, especially if containing egg and butter, which are frequently given to coax the appetites or tempers of these children, should be avoided "*cane et angue pejus*," and I need hardly say that pastry is pernicious in the extreme. Some may think that I am arguing against an imaginary evil, but the ignorance or inattention displayed in the management of children will be found, by those whose professional occupations make them conversant with the nurseries of all classes of society, to be the productive parent of a numerous progeny of children's maladies. One instance in illustration may suffice. A distinguished officer, high in rank and connexions, enquired of the mother of a large family what he could give his children who complained of excessive thirst. The reply, dictated by the sound sense which characterises this lady, was, either milk and water without much milk, or toast and water. At this the father expressed surprise that it should have escaped him to offer them these very simple things, for he had been giving them maresquino in water ; but, for the future, he added, a jug of toast and water shall be always at their command, that they may take it as often as they please. This probably was just a specimen of the rest of the treatment of his children, and explains the fact that, from their unhealthy character, he has lost several after very short indisposition.

It is a statement of Dr. Mason Good, borrowed from Richter, that struma is a "disease of debility," "accompanied throughout with diminished instead of increased irritability,"² and in no parts of the body is this better illustrated than in the eye and the bowels ; in the former by the large and sluggish pupil, in the latter by the costive habit and defective

² Mason Good, v. iii. p. 334, ed. 2nd, 1825.—Richter, Chir. Bibl. Band. viii. p. 501.

powers of digestion. The first is productive of no inconvenience; the latter, unless counteracted, is the source of multifarious mischief. The stomach, offended even by ordinary food, either rejects it, or sends it not well "concocted" into the intestinal tube; this is a source of irritation rather than sustenance, worrying the mucous membrane to the production of slime even sometimes streaked with blood, and too frequently involving in the train of consequences the enlargement and induration of the mesenteric glands, and ultimately *tabes*. Hence the advantage of a due adaptation of the diet to the enfeebled energy of the digestive apparatus; and hence the frequent recommendation of alterative doses of mercurials and of active aperients. Calomel with other mercurials, however, unless where there are unequivocal proofs in the appearance of the excretions of a torpid state of the liver, have in my experience appeared to be rather injurious than useful; but, when the discharges from the bowels betray, in their white or ash colour with fetor, a want of the colouring matter and antiseptic properties of bile, moderate doses may be given until that secretion, so essential to the due performance of all the functions of the intestinal canal, is reproduced, for which purpose alone its employment is to be countenanced. This statement nearly coincides with the judicious observations of my friend, Mr. North, who lays down the very general rules, that "if we have evidence of hepatic derangement, and the stools are of an unnatural appearance, a grain of calomel each night may be given with much advantage. The hydr. cum cretâ is preferred by many practitioners, but calomel appears to me more capable of fulfilling the indication of restoring the healthy action of the liver."³ It is right, however, here to observe, that it is not every case of "unnatural appearance" of the stools which will require or justify the use of mercurials, and this, probably, from the employment of the copulative rather than disjunctive conjunction, was the meaning of Mr. North, which, in that case, involves a proposition at once clear and indisputable by marking more prominently the combination of the two conditions, as essential to the justification

³ On Convulsions, p. 277.

of the employment of mercurials. It is too often the practice, with a view to conciliate the palate of children, to give calomel in honey, sugar, or fruit, jelly or jam; and this is commonly sanctioned by the prescription of the medical attendant, which directs it to be taken "*quovis vehiculo crasso.*" Such "vehicles," however, are at best but indigestible substances and peculiarly apt to ferment, engendering, by the production of acid in the canal, more acrid properties in the mercurial, and occasioning severe gripes;—consequences, which will be materially averted by combining alkalies with the calomel.

Whilst we are thus employed in correcting the secretions of the alimentary apparatus, it is, at the same time, necessary to quicken the passage through the intestinal tube of its contents; but, as far as I have been enabled to judge, the principle which should regulate the administration of purgatives, should be restricted to the prevention of accumulation. It is not required, as in the case of local congestions or inflammations, to reduce the patient by draining the circulation; but, to obviate the accumulation within the canal of such materials as, by their bulk or stimulant properties, may exercise a morbid influence upon that important tube. Saline aperients, therefore, in these cases, are unnecessary; drastic purgatives are injurious; and the mildest, which are effectual, should be selected. If the breath and stools are sour, magnesia will often suffice; but, in an infant, whilst a few grains will commonly succeed, a larger quantity will irritate,—not purge. At the end of near a month from her confinement, a lady sent for me in a great hurry on account of her infant, which had been violently griped, and, though naturally a cheerful child, had been crying the whole night. The infant, according to the nurse, had had "*hysteria*;" by which, however, upon requiring an explanation, it turned out that she meant merely a little darkness about the mouth and eyes, with slight distortion of features;—probably the inward fits of Underwood. To cure this, she acknowledged to have given a *tea-spoonful* of magnesia, and as, after this, the stools were slimy,—not *fœculent*,—she had subsequently treated the child with a tea-

spoonful of castor oil. Simple carminatives had no influence in allaying the irritation of the canal, nor did I gain any ground in relieving it, till I had administered, as an opiate, Dover's Powder, in the dose of one grain; after the soporific effects of this had worn off, the child, though languid and reduced, was permanently cured. I agree with Mr. North in his statement of the inefficiency of manna in many of these cases; and I would add that, where the digestion is impaired, it is apt, by the fermentation which it undergoes and the acid which it then evolves, to produce gripes. I have long confined the use of this very simple aperient to those instances in which the digestion is perfect, but the canal is merely and very slightly torpid; in which case, manna, mixed in small quantity with the food instead of sugar, is a very mild "peristaltic persuader." Castor oil, again, the last of the "milder purgatives," enumerated by Mr. North, is not always to be depended upon, and may offend by its indigestible character, which is abundantly proved by the quantity of the oil which is constantly found in the stools of those to whom it has been administered, sometimes swimming in the form of oily globules on the surface, upon other occasions mingled with the slime of the canal, and looking like half-digested egg. I have, however, more than doubts about the propriety of giving, in these cases, calomel and jalap in combination, or even infusion of senna with tincture of jalap, though commended upon high authority.⁴ These are usually too stimulant in character for general employment, and my experience warrants me in saying that they are not generally requisite. One dose of rhubarb, uncombined where the bowels are irritable, or combined with magnesia, especially in the form recommended by the late Dr. Gregory—now familiarly known as Gregory's Powder—or with soda where acidity prevails, or the infusion of Rhubarb according to the Edinburgh formula, which is more active than the London and, being combined with a carminative, (*Sp. Cinnamomi*,) less apt to gripe, will very commonly effect our purpose; and I prefer giving an efficient dose of one or other of these aperient medicines in the morn-

⁴ North.

ing to the practice, which is, perhaps, more prevalent, and to which I was long addicted, of combining the aperient with other general medicines, whether saline and anti-febrile or tonic, as the different nature of a child's malady might appear to require. An ineffectual purge, however, it is well known, will often produce griping, when one, more efficient from its peculiar properties or the extent of the dose, will relieve; and small doses of opening medicines, frequently repeated, are so apt to produce continuous irritation in the canal, to the surface of which they are applied some four or six times in the twenty-four hours, that I have been tempted very much to relinquish a plan which I have so often found productive of pain and consequent restlessness, without corresponding advantage.

If struma be, as stated by Mason Good, Cooper, and a host of other authorities, a disease of debility, it might be expected that *tonics* would be useful, and we find accordingly that these, by the most unprejudiced writers, have been much commended. If the paroxysms of laryngismus, whether connected with scrofula or not, were the result simply of sympathy with excited or inflamed gums and dental capsules during dentition, or of cerebral excitement, it would be difficult to understand what good could possibly arise from this class of medicines. They might be injurious in such cases of congestion and, perhaps, local inflammation; but it would be inconsistent with the analogy of almost all inflammatory ailments to expect benefit from them. In the state of excitement of the mucous membrane of the intestinal canal, so frequently attendant upon dentition, in which the stools, losing for a while their feculent character, become slimy or streaked with blood, tonics only add to the irritation. The child of a lady in Manchester Square, about two-and-a-half years of age, having been previously in health became, during the severely hot weather of July, suddenly and extremely restless, started in its sleep, lost its appetite and its cheerfulness, appeared pallid, had offensive breath and stools, and was constantly picking its nose; but it had no sustained or even irregular fever. I was told, for I could not at first see them, that the

stools were very disordered. For this child I directed alterative mercurials with small doses of rhubarb, and a bitter infusion with soda. The child, however, had little rest, screamed, obviously from pain, throughout the night, had no increase of appetite, and betrayed altogether the appearance of great indisposition. Relinquishing the Hydr. cum cretâ, I anticipated the cessation of the pain; but these anticipations were ill founded. I was again sent for on the second day after this change, but found no improvement; and now, for the first time, an opportunity was offered me of seeing the discharges from the bowels. I found them consisting of slime, with little feculent matter, but streaked with blood; and the vulva and even bladder had been subject to considerable irritation. This combination of symptoms, so frequently the result of difficult dentition, led me to inquire about the teeth, when I was informed that she had cut all that could be expected at her age: but, upon inspecting the mouth, I discovered that she had yet only sixteen, the gums over the posterior grinders of the lower jaw being somewhat expanded. I now gave up the tonics, and directed merely a simple mucilaginous mixture, with some mild carminative. Upon seeing the child in the evening, all irritation had subsided, the worry of the bowels had ceased, the child was sleeping tranquilly and continuously, undisturbed even by talking in the room or by feeling the skin to ascertain its temperature; and on the following day was convalescent.

This observation appears nearly conclusive as to the evils from the morbid excitement of tonics under such circumstances. They were no sooner given up than the irritation was lessened, and this, notwithstanding that the employment of the gum lance was omitted. It may be conceded, then, that disordered states of the alimentary canal from dentition may be aggravated by mercurials and purgatives, and will scarcely bear tonic medicines; but the observations of the most experienced practitioners coincide in establishing the utility of tonic medicines in the majority of cases of the crowing inspiration of children. Dr. Marsh advocates strongly the employment of strengthening remedies in the laryngismus stridulus;

and, to a certain extent, founds his recommendation of such remedies upon its almost universal association with scrofula. "It seems to me," says this judicious writer, "not unimportant to remark, that all the cases of this disease which I have witnessed, have occurred in children either themselves exhibiting marks of the strumous diathesis, or sprung from scrofulous parents. This bears practically upon the subject, inasmuch as it enhances the value, in treatment, of pure air, healthy nutriment, and tonic remedies." And again, speaking of the treatment of this disease in its uncombined form, he describes it to consist principally in improving the general health, and giving tone to the nervous system; and he further assures us that the "symptoms rarely fail to yield to vegetable or mineral tonics, pure and bracing air, and well-regulated diet."⁵

Where, then, there is no morbid irritation of the mucous lining of the alimentary canal, manifesting itself in slimy evacuations like jelly, with or without streaks of blood; where the enlargement of glands leads to the suspicion of a strumous disposition; where the face is pallid, with the upper lip and septum of the nose thickened; and where the extremities of the cylindrical bones are enlarged, tonics are valuable remedies, and ought not to be omitted.

The selection of the tonic to be employed is of less importance than the establishment of the general truth that it is useful. Some, with Dr. Marsh, recommend quinine; others have an impression in favour of cascarilla or columbo, or camomile, or gentian, or quassia. Some prefer mineral tonics, as preparations of iron, zinc, barytes or lime—if the muriates of the two latter are to be considered as such. But, in truth, there is no catholic remedy of universal application in this disease; or, in the language ascribed to Sir Astley Cooper, "Gentlemen, you may lay it down as an axiom, that there is no specific for the cure of scrofula; and he who says that there is, attempts to gull mankind by the assertion of what is not true."⁶

⁵ Dublin Hospital Reports, vol. v.

⁶ Lectures, 12mo., p. 553.

It would be important if we could determine how tonics act in improving the general health ; but this has been the subject of controversy, and is not yet settled. It is said they give tone ; “ but what is the meaning of tone ? In physiology, in pathology, and in the common language of the multitude, sound, and accordant elasticity ; that voluntary re-action or state of extension between antagonist muscles, as Galen has well observed from Hippocrates, by which they are removed from a condition of rest ; and in which the one yields to the other, not from actual debility, but in a precise ratio to the surplus of power exercised over it. Whence that class of medicines which contributes to this harmonious play of muscular fibres in irritable or weakened organs, is denominated *tonics*, while organs that are destitute of it are said to be in a state of *atony*.”⁷ If, according to Locke, language is an instrument of thought ; if we think through the medium of words, this quotation from one of the brightest ornaments of our profession may be taken as evidence of the obscurity of the ideas of that profession upon this intricate question. That increased muscular power or energy is given in weakened habits by what is commonly designated “ a course of tonics ” is unquestionable ; and as, according to the old logical axiom, “ nothing acts but where it is,” it was thought that medicines of this class, absorbed into the course of circulation, found their way to the muscular structures, strengthened them, and gave them “ harmonious play ; ” in short, that their action upon these fibres, like mercury upon the salivary glands, was specific. But there is no evidence of this ; it is a mere gratuitous assumption, unsupported and even contradicted by experience and analogy. No one, for instance, has detected any of the essential principles of bark in the circulation ; it does not blacken a penknife in the pocket, as we constantly find mercury forming an amalgam upon a gold watch in the fob of a patient, who is indulging in a mercurial course ; and it gives no additional increase of power to a person in health : whilst, *e converso*, where the alimentary canal

⁷ Physiological System of Nosology, by John Mason Good, F.R.S. Preliminary Dissertation, p. 49.

is disordered in its action, where there is digestive disturbance as well as feebleness, where the tongue is foul and the stools are of an unnatural appearance, they are commonly rather prejudicial than advantageous. Yet, in both cases, they might be equally absorbed; for mercury and other agents, which find their way into the circulation through the absorbent system, are taken up under such circumstances; and yet, although there is manifest weakness, this is rather increased than diminished by the tonics; at all events, howsoever debilitated the individual may be, they no longer give "tone" or "harmonious play to the muscular fibres in irritable or weakened organs" or habits.

The master mind of the late Professor Gregory was also applied to this subject, and he came to the conclusion, which I believe to be the accurate one, that the influence of tonics was indirect, and that they only gave strength to the body by assisting the stomach to act more vigorously upon, and to convert, therefore, into aliment the diet employed. In the simple and perspicuous language of Dr. Cullen, they "give firmness and strength to the whole system, and, thereby, to particular parts;" just as with respect to bitters, in which he endeavours to establish the identity of the bitter quality and the tonic virtue, their "most obvious operation is, that being taken into the stomach, they increase the appetite for food, and promote the digestion of it."⁸ Of this principle one of the strongest proofs, that can be given, is that, whilst tonics without an increase of food give no strength, strong animal food without tonics will often succeed; and my readers will probably be disposed to bear with me, if, upon this subject, I borrow somewhat from my early preceptor, Professor Gregory, whose felicity of illustration, even of the most abstruse and intricate subjects, surpassed that of any teacher whose lectures it has been my good fortune to attend. "Our very notion," he says, "of tonics, is vague and indistinct; they are said to be medicines which increase the tone or tendency to contract in muscles; but it is doubtful if, in the strict sense of the term, any such remedies exist. That

⁸ *Materia Medica*, 4to., vol. ii. pp. 53, et seq.

they do not operate by their stimulant power is clear from the circumstance of there being many substances of a much more powerful nature as stimulants, which, however, operate much less efficaciously in the cure of intermittents, in which, probably, they may produce strength by removing the disease which occasions debility, rather than remove the disease by creating additional strength."

"A full diet, with wine or porter, with exercise and, perhaps, cold bathing constitute the most vigorous tonic remedy. This was well known to the ancients, who trained their youths to the gymnasia by giving them large quantities of stimulating animal food, particularly roast pork, which they worked off by very violent exercise. No such extraordinary strength is ever acquired by the use of bark.

"The effects of a peculiar regimen is well exemplified in the training of other animals. The race-horse is hand-fed to induce him to eat a great deal of corn, which is worked off by hard galloping. In the training of game-cocks, too, they first purge them with barley, and then put them under an inverted tub with plenty of meat, so that they shall have nothing to engage their attention but eating. By this they are rendered more strong, and ferocious almost to madness. The same may be observed in another species of animal, the bruiser, who eats large quantities of raw meat, which he is in the habit of working off by very violent exercise; and the same of the pedestrian. But bark, when administered to a person in health, so far from strengthening, would rather induce debility."⁹

Again, speaking of the use of this class of remedies in continued fever, he says, "The use of tonics has been much insisted on; but, perhaps, we know of no substance which has a specific tonic effect. Even bark, which has been so much commended by many, is now rarely employed by me on account of its not appearing to possess any considerable stimulant power, and because, on the contrary, it often tends to depress the system by disagreeing with the stomach and inducing nausea or vomiting;"¹ and that this was not a loose

⁹ MS. Lectures of Dr. James Gregory. On Intermittents. ¹ Ibid. On Fever.

idea floating in his mind, and applicable exclusively to the employment of tonics in cases of fever, is clear from his account of the agency of the same medicines in dyspepsia, upon which my manuscript represents the professor to have said, "Of the existence of such remedies as stimulants, there can be no doubt; but, with regard to an exclusively tonic remedy, it is doubtful if we have such."²

I have little confidence, then, in the doctrine which ascribes to tonics a power of increasing the tension of muscular fibres. I believe, rather, that their power is indirect, and consists in the addition they make to the muscular fibres themselves in the last process of assimilation, the result of that increased energy which tonics give to the digestive organs. Such being the principle of the administration of these remedies, we shall be cautious of giving them in an excited or disordered state of the alimentary canal. If we observe, merely, that the food passes through the intestinal tube in an undigested state, afterwards turning sour if farinaceous, and foetid if of an animal nature, but not accompanied by disordered secretions, tonics will invigorate; but if, in addition, we find that the character of the secretions has undergone considerable morbid change, my experience abundantly warrants me in discountenancing their employment.

Where ordinary tonics in scrofula appear to have failed from their too stimulant properties, those milder forms of similar remedies, which constitute part of an alterative course, are occasionally useful. Amongst these sarsaparilla or sassafras, alone or in combination, hold a conspicuous station. But as these cannot be given to children in sufficient quantity in the form of decoction, the more concentrated forms, as essences, or syrups, or concentrated decoctions with their tendency to ferment counteracted by lime water or an alkali, should be given.

To the same class of medicines ought probably to be referred, if really serviceable, the colts-foot, tried by Cullen, as he thought, with some success upon the testimony of Fuller, the author of the *Medicina Gymnastica*. This remedy was originally proposed as a mild expectorant in coughs, has

² MS. Lectures of Dr. James Gregory. On Dyspepsia.

been used as such from the time of Dioscorides, and even in our own times retains its reputation. As a boy at school, I was often dosed with a slop basin full of sometimes colts-foot, sometimes horehound tea, the latter being preferred, where the cough had been of some standing, on account of its bitter, and therefore supposed more strengthening, quality.³ But, like many other popular remedies, its reputation is now much upon the wane, especially in cases of scrofula, and its fate would seem to prove that the public place no great reliance upon the dicta of the profession; for, notwithstanding the statement of Cullen that he had frequently employed it, but had never found it evidently to be either demulcent or expectorant, and, notwithstanding his high commendation of its anti-scrofulous virtues, it has gone into complete desuetude as a remedy for struma, but has preserved its character amongst the vulgar for its utility in colds with cough.

I have already stated that the selection of the particular tonic is of comparatively slight importance. Dr. Marsh sanctions, by his observations and experience, quinine. I have more frequently employed columbo, or cascarilla, whilst others, again, prefer mineral tonics. Upon the whole, excepting in very pallid pasty children with whom chalybeates commonly agree well, or in very young children to whom medicine must be administered in a small compass, which can be done only with mineral substances, or with quinine which, when highly concentrated, produces great struggling on the part of the child in consequence of its unpalatable character, I generally prefer the vegetable bitters, because with them other important remedies, as soda, ammonia, the foetids, or iodine, to all of which we may occasionally or in succession be called upon to have recourse, may be combined.

As part of the same alterative plan of treatment minute doses of mercurials, such as are known to improve the secretions into the alimentary canal, have been much commended. This, it is well known, has been long a favourite practice amongst surgeons, and I find at the end of five and twenty

³ The first was believed to sheath an irritated, the second to strengthen a weakened chest.

years the same principles advocated, and the same practice pursued in these cases as when I had the advantage of attending the lectures of Sir Astley Cooper at St. Thomas's Hospital. He then, I well recollect, spoke in terms of great confidence of the beneficial influence of a combination of bark with small doses of the oxymuriate of mercury; and in a work which has the reputation of being the last record of his opinions, it is said, *inter alia*, "One of the remedies which we use in the other hospital, (Guy's,) is infusion of chamomile flowers, with a few grains of hydrargyrus cum cretâ at bed-time; or the oxymurias hydrargyri in the proportion of a grain to two ounces of bark: a tea-spoonful of which should be taken twice a day in a glass of the chamomile infusion. It is hardly necessary for me to state that in this form the oxymuriate is decomposed and becomes less acrid; but experience, notwithstanding these "incompatibilities," has sanctioned the unscientific compound, and in many cases, therefore, of scrofula it may be administered with some prospect of success. Other forms of mercurial have been also recommended, as the plumber's pill where the child can swallow a pill, or calomel with soda or with minute doses of ipecacuanha or of antimony, or the hydrargyrum cum sulfure. I have, however, no great confidence in their virtues, having tried them with, at best, very equivocal success.

Where the child is old enough to take a glassful of medicine the formula above mentioned may constitute a very good remedial agent; but such doses it is useless to attempt to give to infants, who are peculiarly the subjects of the laryngismus. Besides, such children are very subject, from the irritation of undigested food, to a morbid sensitiveness of the alimentary canal, and I have again and again in such cases seen mercurials aggravate materially the intestinal disturbance, add to the emaciation by occasioning defective nourishment, stimulate the lining membrane of the tube to great additional secretion of mucus often, under such circumstances, tinged or streaked with blood, sometimes by the same agency produce tabes from enlargement of the mesenteric glands or marasmus, from ulceration of the intestinal tube, and even occasion,

by irritating the muscular apparatus of the canal, such intussusception or invagination of intestine, that the colon has, in some instances, contained a large portion of the small intestines. Upon the whole, therefore, I now rarely employ mercurials excepting under the restrictions and for the purposes already stated; and these, in my belief, constitute the legitimate regulating principles of the administration of this potent agent,—powerful, according as it is administered with discretion or indiscriminately, either for good or for evil, and constituting accordingly either a blessing or a curse.

Another remedy much in use in scrofula is soda, or some other form of alkali. This class of remedial agents was originally suggested upon the supposition, assumed, by the humoral pathologists, that struma depended upon a specific acrimony in the circulating fluids, believed to be essentially acid. But this has never been subjected to any sufficiently rigid examination, the evidence adduced in its support is altogether inconclusive, and the opinion is much too fanciful to modify our practice, or to influence our selection of individual remedies.

But although “we have assuredly no proof that these become beneficial as correctors of acidity,”⁴ if this expression be intended to apply to the whole circulating mass, yet they may be very beneficial as “correctors of acidity” in the *primæ viæ*.

In all cases where the digestive function is impaired, and where acid, as its consequence, is generated, alkaline substances constitute very important remedies; and hence their utility not only in dyspepsia, but also in this disease, in which we have seen that the function of digestion is impaired. Even where the evidence of acidity is not obvious or conclusive but is merely suspected, or where our object is to prevent its formation, alkalies may be given, and good will often result; just as with wet-nurses, who take the same beer with the rest of the family all of whom appear to drink it with at least impunity if not with advantage, we often find that the child, previously griped, will be relieved of the symptom upon adding

⁴ Mason Good.

carbonate of soda to that which is taken by the nurse. The form in which the soda is recommended by Richerand would seem to prove that it was upon a similar principle, of improving the digestion, that he recommended it in scrofulous cases, or the combination with it of a spirituous infusion of gentian would hardly have suggested itself to his mind.⁵ This, I believe, then, to be the mode of agency of these remedies; and to the objects of obviating or counteracting acidity in the primæ viæ, which, although the result of weakness and consequent fermentation of vegetable substances, will still by reflex operation influence injuriously the digestive apparatus, should their administration be restricted. Others have preferred the carbonate and other forms of ammonia, and advantage is frequently derived from their use; for, like soda, they counteract acidity and, at the same time, expel flatus, which, as a cause of distention, may and frequently does aggravate the other evils of indigestion, and by the embarrassment it occasions in the respiratory function produces a more frequent recurrence of the attacks; and in the expulsion of this is not unfrequently involved the cessation of a paroxysm.

Iodine is another remedy much in vogue for the cure of scrofulous tumours, and it may be therefore employed with some, perhaps considerable prospect of advantage. It is an interesting fact which adds greatly to my confidence in the doctrines which I have advanced with respect to the constriction of the glottis in children, and corroborates the impression entertained by Dr. Marsh of its almost universal connexion with a strumous constitution, either engendered in the individual without hereditary taint or derived from the parents, that we find the two great remedies relied upon by Dr. Merriman, in addition to aperients, to be soda and burnt sponge.⁶ It is evident from this statement that Dr. Merriman considers soda to have some other medical properties than those of obviating acidity and relieving distention, although, from the obscurity

⁵ Nosographie Chir. tom. i. p. 184, edit. 4.

⁶ If timely attended to, the complaint commonly yields to daily aperients, so as to produce at least two copious motions; and continued doses of soda, or a strong infusion of burnt sponge, with proper attention to diet and regimen.—*Underwood on the Diseases of Children*, 8th edition, p. 139, note.

in which the pathology of this disease has been hitherto involved, he had necessarily great difficulty in explaining its beneficial agency in this disease. His testimony, however, much strengthened by subsequent observation, to its utility in this disease, certainly affords collateral and corroborative evidence of the accuracy of the views which I have been disposed to entertain of the essential pathological condition in the great majority of instances of this disease, seeing that soda has long been a favourite remedy in obstructions and other morbid affections of the lymphatic system, especially those connected with a strumous habit. Similar observations apply to the "strong infusion of burnt sponge," or, what is equivalent to it, "lozenges of burnt sponge." These were long commended as empyrical remedies in scrofulous enlargements of the lymphatic glands, even when the proximate principle upon which their efficacy depended was yet wholly unknown to the profession and, at all events, was confounded with soda. This confusion existed even in the discriminating mind of Dr. Mason Good so late as 1825; for having spoken of the coarser forms of alkalies which had been administered, and to which he refers the agency of certain popular remedies in scrofula, amongst which he enumerates burnt sponge, cuttle-fish, shells of all kinds, and even secundines, (the last of which, in their burnt state, were once considered a sovereign remedy,) he adds, "all these have in our own day deservedly yielded to the carbonate of soda or subcarbonate of ammonia; which, in a more elegant and concentrated form, offer whatever virtues may be contained in the older medicines; and still more lately to the different preparations of the alkali, not long ago detected by M. Courtois, in kelp and other salt-worts, and denominated "iodine."⁷ That soda and iodine exist in combination in this family of plants is unquestionable, but they are distinct and separable essences; and it is probably to the latter, in conformity with the views first announced by M. Coindet of Geneva, that the specific effects of the burnt sponge in bronchocele and in scrofulous tumours should be referred; and as it seems now to be ascertained that the be-

⁷ Study of Medicine, 2nd edition, 1825, vol. iii. p. 344.

neficial effects of the sponge are to be ascribed to the iodine which it contains, it will be better to employ this essential ingredient uncombined with the other products of the combustion of those maritime plants, which are inert and therefore useless. We can thus determine more accurately the dose of the active principle, and we avoid the risk of substitution and adulteration, sins of omission and of commission, which my friend Dr. Gairdner states, upon authority that I know to be unquestionable, are far from uncommon in the burnt sponge.⁸

Iodine or its salts may be employed both externally and internally. The neck and upper part of the sternum may be rubbed twice daily with any simple unguent containing about one eighth of the hydriodate of potass, whilst for administration internally the solution of the hydriodate of potass, according to Majendie's formulary, constitutes as good a form as can be selected.

Many have thought, and still think, too lightly of the influence of this remedy ; it has been considered by some as powerless alike for good or for evil. To counteract this too prevailing impression was one great object of the interesting little work upon iodine, published some years since by my very excellent friend Dr. Gairdner. He has had numerous opportunities, both in this country and in those districts of the continent where the frequency of goitre leads to the extensive employment of this remedy, of noticing its influence, and he has borne ample testimony not only to its efficacy in many cases, but to the injurious effects which it is capable of producing in some constitutions, when given in too large doses or too long continued.

The muriates of barytes,⁹ lime,¹ and soda,² have also had their advocates in the cure of scrofula. But, notwithstanding the high encomia passed upon these remedies, their efficacy is more than doubtful. The two former of these medicinal agents, like the Portland powder in gout, are amongst the many remedies "*quorum ortum, et splendorem, et occasum*

⁸ Gairdner on Iodine, p. 3.

⁹ Hufeland, Crawford, Pinel.

¹ Wood, Swediaur.

² Russel, and almost all subsequent writers.

vidi;"³ and as to the latter, I am not aware that any one has recommended it in its pure and uncombined state in the sick chamber of a London house, but "generally through the medium of sea water internally, or of the bibulous marine plants which contain it in a larger proportion, and which have been applied to strumous tumours in the form of epithems, as sea-wrack (*fucus vesiculosus*), sea-tang (*alga marina*), and sea-oak (*quercus marina*);⁴ or as part of "a tonic regimen of sea-air, sea-bathing, liberal exercise, and a diet somewhat generous, which is of the highest consequence in promoting improvement, and ought by no means to be dispensed with. The infirmary of Margate is, on this account, a noble institution, and cannot be too liberally supported."⁵ In this respect the sea-water may be fairly placed in the same category with the other mineral waters, all of which are said to have been occasionally useful. "The remedy," says Dr. Cullen, "which seems to be the most successful, and which our practitioners especially trust to and employ, is the use of mineral waters; and, indeed, the washing out by means of these the lymphatic system, would seem to be a measure promising success; but in very many instances of the use of these waters, I have not been well satisfied that they had shortened the duration of the disease more than had often happened when no such remedy had been employed."

"With regard to the choice of the mineral waters most fit for the purpose, I cannot, with any confidence, give an opinion. Almost all kinds of mineral waters, whether chalybeate, sulphureous, or saline, have been employed for the cure of scrofula, and seemingly with equal success and reputation: a circumstance which leads me to think that, if they are ever successful, it is the elementary water that is the chief part of the remedy."⁶

This statement wants much of the usual perspicuity and precision of Dr. Cullen, who saw indeed the necessity of tracing something common to all these waters, to which the benefit

³ Heberden.

⁴ Mason Good, vol. iii. p. 345.

⁵ Good, p. 347.

⁶ First Lines, § 1753, 1754.

derived from their use, if any, should be referred; and it affords an admirable example of the extraordinary conclusions to which generalizations, too hastily adopted, inevitably lead. This distinguished professor had been led, upon data far from satisfactory, "to conclude that scrofula depends *upon a peculiar constitution of the absorbent vessels and glands,*" for which "the washing out of the lymphatic system would seem to be a measure promising success;" and he hastily infers, from the general and sweeping statements of many writers in favour of various mineral waters of all kinds, that this operation of washing out the lymphatic system is effected by "the elementary water," which they all contain. There are few, I apprehend, in modern times who believe this peculiar but undefined condition of the lymphatic system to be the cause of scrofula, or who would place much reliance upon this mechanical explanation. It is obvious, however, that these mineral waters cannot be generally efficacious, simply and exclusively, in consequence of that peculiar ingredient from which they derive their name. Dr. A. T. Thompson has enumerated no less than thirty-five different substances, simple and compound, found in the various mineral waters;—some tonic, some said to be slightly sudorific and diuretic, some aperient, and all arranged under four classes, "acidulous," "chalybeate," "sulphureous," and "saline." Now, it is irrational to suppose that constituents, so different in chemical and medicinal properties, can cure any one given ailment; and if pure water were the efficient agent, "the sovereignest thing on earth" should be snow water, or rain water, or distilled water drunk *ad libitum*. No one, however, would think of confiding in the latter, and we must seek further, therefore, for an explanation of the beneficial tendency of these natural springs.

It is with these as with sea-water. Little advantage is derived from either unless the patient goes to them. They may be considered, to a certain extent, as modern temples of Hygeia placed, as of old, in places not easily accessible, and thus insuring that the votaries of the goddess shall not be in a state

so reduced as to place them beyond the chance of recovery. In the case of adults many subsidiary agents are also in operation to increase the beneficial influence of these mineral springs, amongst which may be enumerated change of air, the charm of novelty, the more regular habits of sleeping, exercise, and diet, absence from business, amusements in the open air, and the avoiding of heated rooms; but in the child there is little more than the change of, and the free and frequent exposure to *a pure air* to explain the effects. Some prefer the sea in scrofulous ailments to all other situations, howsoever salubrious these may be; and so universal has been the belief in its efficacy, that it is almost heretical to doubt it. I have, however, seen many instances in which it has been far from serviceable, and upon some occasions even injurious; indeed, upon the whole, if my experience deceive me not, I should have little hesitation in affirming that I have seen infinitely less advantage from the sea-side, with or without bathing, both in scrofula and in the disease of which I am treating which is so intimately allied to struma, than the writings of authors of eminence had led me to expect. I have recently seen two instances with respect to both of which I have had frequent communications from the country, and which strikingly illustrate my argument. In one, (a sister of the child whose death was owing to suppurative inflammation of two of the bronchial absorbent glands with enlargement of others), in whom there was wheezing with cough so like hooping cough, that the friends had recourse to the popular remedy, "salt of tartar and cochineal," for its relief, the progress of the disease was checked by keeping the child constantly in the country, her time being divided between the more healthy, because higher parts of Essex, Bedfordshire, and Hampshire at a considerable distance from the sea. In the other, a swarthy, dark complexioned, black-eyed child of a father whose look is unhealthy, and of a mother herself of a very delicate family, the wheezing and cough, evidently connected with glandular enlargement in the neck, continued unabated during a residence of nearly three months at the Isle of Wight, but disappeared immediately upon her return

to that more dry and airy part of Mary-le-bone, which is upon a gravelly soil, and in which the parents reside.⁷

Upon the whole, then, the sea side exercises no specific influence upon these cases, and I believe the sentiment ascribed to Mr. Abernethy, and which bears internal evidence of being his, to be a very near approximation to the truth. "Supposing," he is represented to have said, "you were to take a child having enlargement of the glands of the neck, enlargement of the joints, and so on, to a surgeon, what would any medical man say? Why he would say, you had better go to the sea; and what would he mean by going to the sea? what, but to get the child into a better state of health; not that there is any thing specific in the sea water to cure scrofula, for there are many children who live on the sea-shore who are subjects of scrofula. He means simply that you are to change the air and attend to the general health."⁸

A very interesting example of the beneficial effect of change of air in these cases occurred some years since in the practice of my excellent friend, Dr. Merriman, upon whose authority I venture to mention it. The child of one of the great brewers of this metropolis had been for some time the subject of this disease, when a consultation was held upon its case with the late Dr. Sims. This experienced physician, in the course of his observations upon the case and the treatment commonly adopted for its cure by an eminent contemporary, spoke in terms of the strongest reprobation of the large bleedings with reiterated doses of calomel, to which it was *his* habit to have recourse; adding, that he knew of nothing that promised any considerable chance of success but change of air. A lodging was consequently taken for the child at Clapham, where, after a little time, it was so improved that it was thought justifiable to bring it back to London. Here, however, the malady re-

⁷ This child has been since under the care of an eminent surgeon on account of an indolent affection of the knee, for which she has been kept for months upon the sofa, and had also, for a very considerable period, a small open ulcer immediately beneath the symphysis of the lower jaw, the consequence of a slowly suppurating gland there; both strikingly illustrative of the character of its constitution.

⁸ Lectures on Anatomy, Surgery, and Pathology, &c. p. 139.

turned, and after more than one trial the parents at length thought it right to take up their permanent abode in a district, which had thus constantly restored their child to health. This sacrifice of their personal convenience to the welfare of their child was amply rewarded by its perfect and permanent recovery.

A fashionable French milliner in the neighbourhood of Bond-street, had lost one of her children from this complaint ; the case had been treated with the orthodox remedies, with, at least, orthodox activity. It had been largely bled, purged, and calomelized, with, at all events, no permanent good effect, for the child died. A second child in the same family, about the time of teething, became affected with the same croupy inspiration, on account of which I recommended that a lodging should be taken for it in the country. It was sent to Leyton, on the borders of Epping Forest, where it remained until it had cut the cuspidati, the eye-teeth as they are called. The crowing ceased soon after the child went into the country, and it still remains free from the disease.

This change of air even to the sea side where the patient is a resident of an inland situation, or to a more healthy and airy situation upon the coast when the residence happens to be low, moist, and relaxing, or to an inland situation where the disease has originated during a permanent residence or has derived no advantage from a temporary sojourn at the sea side, or to either after a long confinement in the metropolis or a large provincial town, acts beneficially in several ways. First, it influences the process of teething. Children who are suffering from dentition are materially benefited by the change. The teeth advance with less pain and more regularity in the country than in great towns, and therefore irritate the contiguous absorbent glands less. Hence there is some foundation for the statement, although it is unquestionably overcharged, that "large cities do not afford a sufficient number of perfectly healthy individuals to determine what is the natural order of the appearance of the teeth, or what is the proper ratio of size of the teeth to the jaws."⁹

⁹ Dr. Ashburner's Reply to Mr. Hunter in *Med. Gazette*, Dec. 21, 1833 ; also on Dentition and some coincident disorders, p. 57.

This change has also a great tendency to restore vigour to the impaired digestive function, and thus to improve the strength. There is no one, much confined by his occupations to London or large cities, who does not find that he can take and enjoy food much more frequently in the day, that he finds less distension and discomfiture after eating, and that he can take much greater liberties with his stomach when breathing the pure air of the country, than whilst he remains among "the busy haunts of men." It is the same with children; whether living at the breast or upon spoon meat, it is constantly found that the functions of the alimentary canal are better performed upon sending them to the sea side or into the country; and thus a continual source of local irritation and constitutional disturbance is removed. They improve, therefore, in health and strength, and in this improved condition of the digestive apparatus will be necessarily involved the diminution of the glands. For if it be true that scrofula is a disease "springing from debility," and if one of the fundamental principles of medical science be accurate, that "*causâ amotâ tollitur effectus*," it must follow that whatever is calculated to restore the strength must assist materially in diminishing the glandular tumours.

If the child be sent to the sea side, the question as to the propriety of bathing will always be referred to the medical attendant. In cases of scrofula, occurring after infancy or childhood and as the patient approaches the age of puberty or virility, the cold salt water bath is often useful; and, perhaps, even crowing children might have their glands somewhat diminished by the remedy. But this will frequently be effected at the imminent risk of increasing the frequency of those attacks of constriction of the glottis which constitute the leading feature of, and give a designation to this disease. It has been already seen that cold suddenly applied to the head has occasioned the first of a series of paroxysms of this kind, and with still greater certainty will dipping the child occasion it. Even a healthy child plunged suddenly into cold water will often have its breathing interrupted for many seconds, and if there be any cause, as we know to be the case in

this disease, which after such closing of the glottis can enfeeble those powers which should be exerted to re-open that chink, the breathlessness may amount to asphyxia, from which, if the child survive, as in the majority of instances it will, it recovers with that sonorous inspiration which marks an imperfect opening of the rima glottidis.

This effect upon the organs of respiration is the compound result of the well-known sympathy between the surface and the respiratory apparatus, of driving the blood from the circumference to the centre, and of the fright which, as we have already seen, may, itself, produce paroxysm ;—or, if the child escape the prejudicial agency of these causes, if by the violent fit of crying, which succeeds, the harmonious action of antagonist muscles be destroyed, the closing muscles, being in vigorous, violent, and reiterated action, will close the glottis, whilst the opening muscles, having their energy impaired, are unable so efficiently to contract as to separate from each other to the proper extent, if at all, the adjoining edges of the arytenoid cartilages.

But the warm sea bath is often beneficial. This has a tendency to equalize the distribution of blood, instead of driving it to the centre and thus loading the vessels of the chest, and may therefore be of service; unless, indeed, the child be terrified by its use, in which case it will commonly be found to be rather disadvantageous than useful. I prefer, upon the whole, the tepid bath of about 96°, in which, if the child be not frightened, it may be allowed to remain about five minutes, after which it should be quickly dried by putting it into flannel previously warmed, and by rubbing the surface with a towel sufficiently coarse to excite a vigorous circulation in the cutaneous vessels, without giving pain.

As far as regards local applications to the tumours which are the direct cause of the paroxysms in this disease, with the exception of the iodine ointment the influence of which is rather constitutional than local, they are little worth. The glands affected are either the deep-seated glandulæ concatenatæ or the absorbent glands of the thorax. The former, if painful, may be leeches and fomented, but they seldom re-

quire these remedies, as they very rarely go on to suppuration; whilst the latter, although they may inflame and suppurate, are beyond the reach of local means, even if we could be quite certain of their existence in an individual instance.

Inflamed Scalp.—It not unfrequently happens that the enlargement of the cervical glands and the consequent croupy inspiration may, without any strumous taint either hereditary or acquired, be produced by some simple cause of excitement acting upon the nearest adjoining glands, just as the inguinal may be enlarged from chafing of the nates or lower extremities, or the axillary by punctured, or other wounds of the hand; and in such cases our course is simple. We have only to remove the cause of irritation and the symptoms will subside. The *exciting* causes capable of producing morbid enlargement of these glands have been briefly enumerated by Cruikshank, and the operation of each in producing the laryngismus stridulus has been exemplified in the cases which I have related. In the instance of Scott the cause of the enlarged glands and the consequent crowing was a scabby eruption, allied to crusta lactea, of the face and scalp; in that of Rycroft it was what is commonly called a running tetter; in that of the child of a medical friend it was teething; in that of W. C. the disease was probably the compound result of head-affection and teething acting upon a scrofulous habit.

In the *porrigo larvalis*, crusta lactea, or milk crust, soothing applications, as warm water, milk and water, or, where the crusts are very thick and hard, even bread and water poultices may be applied to promote their separation; after which an unguent, either soothing or slightly stimulant according to the appearance of the surface beneath the scab, may be used with advantage; if excited, the ceratum plumbi acetatis, or this combined with ung. zinci may be gently applied with the extremity of the finger; if indolent, as in scrofulous habits, (in which, according to Burns, it is particularly apt to occur, and from which connexion it is that, according to Bateman, "it is apt to lead to enlargement of the mesenteric glands followed by marasmus, diarrhoea, and hectic," and, I may add, at the same time to the crowing inspiration,) then, the

unguentum hydrargyri nitratis, diluted with from one third to one half of lard or of any simple unguent, is more useful. Such cases are also benefited, in general, by mild alterative mercurials, moderate aperients, alkalies especially soda, and, when of long continuance, by gentle tonics.

The same principles of treatment, and even the same individual remedies, are applicable in those cases of acrid excoriations behind the ears, which by contiguous irritation have occasioned enlargement of the cervical glands, and, consequently, produced the laryngismus stridulus. But as it is not uncommon for this affection of the integuments to be attended with much erysipelas, with which unctuous applications do not agree, we may in such cases, after fomenting with warm water, milk and water, or poppy fomentation, apply, if the surface be irritable and the discharge very considerable, the white oxide of zinc in the form of powder, taking care at the same time to keep up a gentle action upon the bowels by mild aperients.

DENTITION.—By far the most frequent of these local irritations is painful or difficult dentition; and hence all writers lay considerable stress upon the propriety of lancing the gums. Some would defer this operation until the teeth are near the surface, and have occasioned considerable swelling and inflammation of the gums. But long before we have this external evidence of what is going on, irritation or inflammation of the dental capsule may produce great increase of the salivary secretion, much general disturbance, and sympathetic swelling of the absorbent glands.¹ When, therefore, the

¹ M. Billard has given two striking examples in which, at a very early period of life, congestion of the membranes of the teeth led to an effusion of grumous dark-coloured blood, and a separation from the capsules in one instance of three teeth, in the other of several, which were found loose and detached in the midst of the blood, which had produced swelling of the gums. In the first case, the child was only six days old, when diarrhœa commenced and destroyed the infant in thirteen days. In the second the child was twenty days old, and the principal symptoms were tumefaction and redness of the gums, aphthæ, vomiting, irregular fever with evening exacerbations, *spasmodic cough like whooping cough* in the character of its fits, œdema of the feet, and difficult deglutition. the infant sinking within a week from the attack.—*Traité des maladies des enfans nouveau-nés et à la mamelle*, p. 265.

crowding inspiration occurs before the deciduous teeth have reached even nearly to the surface of the gums, and the cervical glands are found, or even suspected to be, enlarged without other assignable cause, we should direct our attention to the teeth, and we shall be abundantly justified in having recourse to an "*anceps remedium potius quam nullum.*" We ought to lance the gums and divide the membrane of those teeth, which, according to their usual order of succession, may be expected to be advancing. Some fear that the cicatrix may interrupt the subsequent progress of the teeth;² but this speculative objection has no real foundation, and is opposed to the results of experience. The teeth will afterwards penetrate the gums with at least equal celerity, and certainly with greater immunity from suffering. Others, and amongst them surgeons of very enlarged experience, assert that a cicatrix will give way to internal pressure more readily even than a natural texture, and I well recollect a most eminent hospital surgeon in one of his published lectures considered the point so satisfactorily ascertained with respect to a gum after the employment of the gum-lance, that he adduced it as a most convincing illustration of the general principle.³ In truth, the practice of thus dividing the gum, together with the dental capsule, is productive of no further mischievous consequence, than the probability of the occurrence of a paroxysm from the pain and the screaming consequent upon it, with the addition of a little subsequent soreness; but these are evils temporary and slight in character, and not to be put in competition with the advantages, which may be fairly anticipated from removing a source of irritation, which, if allowed to continue, may be productive of very serious results. Indeed, it may be said of this remedy, as Dr. William Hunter is represented to have said of at least a small bleeding in threatened miscarriage, "it can do no harm, it may do good, and it ought therefore never to be omitted."

It is not enough, however, to have thus early recourse to the gum-lance, unless, at the same time, we use it efficiently. The gum, together with the membranous covering of the teeth,

² Van Swieten, Guersent, Billard, Camus, Dugé.

³ Sir Astley Cooper.

must be freely divided; the practitioner should not be satisfied till he feels or hears the instrument grating upon the tooth.

The principle of this little operation does not seem to be very well understood, in consequence of its not having been yet definitively determined what is the precise condition of parts in difficult dentition, upon which the mischievous results depend. It seems to have been a very general impression, that the evil consequences arise from the tooth outgrowing its capsule, which is, therefore, in a state of unnatural and painful tension, and that the benefit, derived from lancing the gums, is to be ascribed to the membrane being relieved and prevented from re-union by incision. Hence the preference, amongst many practitioners, of a gum lance for the purpose, which has been blunted by frequent use, because, as this will bruise as well as cut, there will be less danger of the parts re-uniting. But that the symptoms are always, or even generally, the result merely of the membrane of the tooth being put upon the stretch, is a mere speculative notion, unsupported by evidence, by reasoning, or by analogy.

The pathological observations of M. Billard, above referred to, seem to show that the parts concerned in dentition are in a state of high congestion; the gums are obviously swollen from that cause, combined, on many occasions, with actual inflammation; in some instances, even puriform matter has escaped from the incision made with the lance; and it is, therefore, more than probable that the capsule itself of the tooth is also in a state of inflammation, and that it is to this, rather than simple tension of the membrane, that the evils of teething should be referred. If each tooth had been contained in a loose bag without vascular connexion between the two, then, it might be easy to comprehend that the capsule might be painfully stretched. But this membrane is the vascular matrix of the tooth itself, with which it grows *pari passu*, depositing in plates the enamel upon the surface of the latter; and when it has performed this office, "it becomes gradually thinner and less vascular, and is at last quite absorbed."⁴ That the

⁴ Ashburner on Dentition, p. 40.

pressure of the perfected tooth may have something to do with this is possible; but it is more probable, upon the whole, that the membrane, now no longer requisite, disappears by a process nearly allied to that, by which the thymus gland and renal capsules are removed when no longer useful, and just as nerves become atrophied, when the organs to which they minister have been destroyed. Whilst the membrane of the tooth is engaged in this important office its vessels are in activity, and slight causes are sufficient to increase their action to the production of inflammation; and, whatever may be said of other maladies connected with painful dentition, at least with respect to the crouching inspiration of infants, it is more than doubtful, and would be contrary to all analogy to suppose it, whether the complaint can be occasioned by anything short of an inflammatory affection of the alveolar processes, the dental capsules, or the gums. It has been seen how constant is the connexion between "child-crouching" and some enlargement of absorbent glands; but in no part of the body does simple stretching of a part, or congestion, or mere pain without the "disorganizing process" of inflammation produce sympathetic enlargement of contiguous glands; and, since a very frequent consequence of difficult dentition is morbid enlargement of the glandulæ concatenatæ, leading to attacks of laryngismus, it is difficult to resist the inference, that, in these cases of irritation from teething the gum and membrane of the tooth are both inflamed.

Reasoning, also, from the effects of lancing leads to the same conclusion; for, if the croupy inspiration depended solely upon the mechanical stretching of a sensitive membrane, the symptoms should cease immediately upon dividing the capsule. But although this may sometimes happen, it is at least very unusual. "It seldom happens that the symptoms subside until the appearance of teeth. I do not mean to assert that they vanish instantaneously, as if by magic, the moment a single tooth starts through the gum: they pass off gradually."⁵ This is true, and easily explained. Inflammation of the gums and capsule have, in conformity with the accurate observa-

⁵ North, p. 261.

tion of Cruikshank, occasioned tumid glands, which have produced the crowing: upon diminishing the inflammation by lancing, the glands will *gradually* subside, and the crowing cease.

Inflammation, therefore, rather than simple tension, being the cause of crowing through the intermediate agency of enlarged cervical glands, the object in lancing the gums should be to subdue this inflammation. But lacerated and contused wounds are much more apt to inflame than simple incisions; whilst the latter, also, have a great tendency to produce such loss of blood from the cut surfaces as will relieve the inflammation of the part. It is upon these grounds that I differ from many of my professional friends in using a sharp instrument in preference to one that is blunted; whilst, for the same reasons, I adopt their practice of making, at least over the molares, a crucial incision, which enlarges the bleeding surface; or, what I think is still better at once to attain this object and to prevent the re-union of the parts, I would recommend two elliptical incisions, meeting at their extremities, by which a lengthened portion of the gum is removed, and the bleeding surface increased in extent.

The cuspidati or eye-teeth, however, often linger after their capsules have been repeatedly divided. In this case they are, probably, embarrassed from want of space to rise between the adjoining teeth. In such instances, I have known the divided gum hanging, like a loose wet bag, upon the point of the tooth, but no longer attached to its surface. It is obvious, from touching the tooth with a metallic substance, that its summit is entirely freed from its capsule, and yet the symptoms continue. In these cases, it is probable that the alveolar processes themselves, or the roots of the teeth, may have become inflamed, and it has been recommended either to draw the tooth itself or the adjoining molar tooth, or to chip off, with a pair of pincers, the edges of the alveoli.⁶ I have not, indeed, had recourse to either of these operations; but, in case of an obstinate continuance of this disease, or the occurrence of general convulsions not yielding to other measures,

⁶ Levret. Baumes.

I should not hesitate to recommend the removal of the adjoining tooth.

Head Affection.—But this complaint has occasionally an intimate connexion with morbid excitement within the cranium ; and this relation, it appears, may be one either of cause, coincidence, or consequence.

When the head-affection is the original producing cause, the nature of the association will be understood by the symptoms of cerebral disturbance, especially general convulsions, preceding both the tumid condition of the glands, and the crowing which results from their enlargement.

When the two maladies are mere concomitants, they are generally the result of a scrofulous disposition, the common cause of both ; and of this, the most unequivocal examples are those where the cervical glands escape contamination, but where, without other disease of the thoracic viscera, the absorbent glands of the lungs are affected.

When the head-affection is the consequence of the interruption to the venous circulation produced by frequent attacks of asphyxia and crowing, as in some cases related by Dr. Clarke, Mr. Pretty, and Dr. Marsh, the child will be sometimes, for weeks, or even months, liable to attacks of laryngismus before the symptoms of cerebral disturbance manifest themselves : but these, at length, appear, first, in the form of torpor from venous congestion with somnolency, (the *assoupissement* of Cruveilhier,) dilated pupils, occasional squinting, and carpo-pedal contractions ;⁶ then, in the form of cerebral excitement, characterised by fever, flushed countenance, morbid sensitive-

⁶ Even Dr. Clarke, who considers the carpo-pedal contractions as convulsive affections when associated with “ a peculiar convulsion of infant children,” by which he meant the laryngismus stridulus, acknowledges that they may be also, occasionally, the result of torpor or paralysis. “ Sometimes,” he says, “ the convulsive affections are partial, more particularly attacking one side of the body ; and not uncommonly, when this has been the case, that side becomes permanently paralytic ; and, in many instances, where children have recovered after such partial convulsions of one side, the arm, or leg, or both extremities of that side remain paralytic during the rest of life : but the flexor muscles sometimes recover a slight degree of power, and, being stronger than the extensors, bend the hand downwards, and turn the sole of the foot inwards”—*Commentaries*, p. 131.

ness of the eye and ear, loaded conjunctive, contracted pupil, hot scalp, prominent fontanelle, cranial perspirations, "screaching fits" awakening the infant from its sleep, and general clonic convulsions with foaming at the mouth, want of consciousness, and succeeding drowsiness; and lastly, assuming the character of cerebral pressure, with cold surface, amaurosis, permanently dilated pupil uninfluenced by light, tremulous convulsive movements, sometimes paralysis of the extremities, and involuntary evacuations.

In each of these cases some modification of the treatment is requisite. In the first, there is great arterial impulse—in all probability inflammation—to be controlled; the same observation, "*mutatis mutandis*," applying to this state of things, as I advanced with regard to dentition. In these instances, the affection of the head causes enlargement of the cervical glands; mere congestion, however, or even vascular excitement at a distance from the glands, without actual inflammation or, at least, some disorganizing process, never produces such enlargement; and hence the inference, that inflammation actually exists requiring active measures for its control.

It would be foreign from my purpose, and oblige me unduly to transgress the limits within which I must confine myself, to enter at large into the treatment of these cases of active cerebral disease. I shall content myself, therefore, with enumerating the remedies in which the most judicious practitioners have reliance; and these, in the early stage of the disease, are blood-letting in its various forms, calomel in frequent doses, active purgatives, stimulant glisters, cold washes to the head, sinapisms to the feet or legs short of raising blisters, the warm or, rather, tepid bath, antimonials, nitre, or digitalis in such doses as will control inordinate arterial action, and low diet; and, in the stage of pressure with paralysis, mercurial inunction, digitalis and other stimulant diuretics, perhaps foetid and "*fit*" remedies, which address themselves strongly to the senses of the attendants, if they do not contribute largely to the cure of the malady, and even, under the restrictions laid down by Dr. Clarke, opiates.

In the second form, in which there is such strong suspicion of scrofula, the treatment, upon the whole, must be less energetic, lest, in curing the cerebral malady in a crazy constitution, we kill the child. The same principles of treatment are, however, applicable, with this addition, that it might be, perhaps, desirable to put the child as speedily as possible under the influence of iodine.

In the last form of the association of head-affection with the crowing inspiration, in which the series of evils referrible to the cerebral circulation are the consequence of the frequent interruption to the breathing, a single bleeding may be requisite to relieve the loaded veins and sinuses, yet more caution is requisite in the application of the remedy. What blood is taken, it were better, perhaps, to draw at once from the external jugular vein; but venous congestion and its consequences neither require nor bear such active remedies, as original arterial excitement. It must be recollected, also, that this state of cerebral congestion, followed by excitement with its formidable train of consequences, is coming at the end of a chronic malady, against which, together with perhaps over-active discipline, the child has been long struggling, and is unable, therefore, to encounter the heroic remedies so much vaunted in these cases. It is not until towards the formidable and fatal conclusion of this complaint that convulsions are apt to occur; and although under such circumstance, as the only chance for the preservation of the child, we may be disposed to sanction active, or rather severely lowering treatment, yet it very commonly fails; and I have seen it again and again, when very injudiciously persisted in, productive of serious mischief.

It is in the two last forms of the combination of these maladies that change of air is so particularly useful. In the active stage of hydrocephalic excitement or threatening, when it precedes the glandular enlargement and crowing, to send the child into the country without subduing the inflammatory affection within the cranium, would be to seal the fate of the child. But if, after having subdued the convulsions which are the great evidence of that excitement, the glands remain obsti-

nately unyielding, and the crowing inspiration continue, country air will do more to remove this secondary ailment, than any remedies with which I am acquainted. In the second form, also, the cerebral symptoms must be combated, before the child is sent into a purer atmosphere for the cure of its coincident strumous complaint or constitution; but in the last, we should anticipate the head-affection by enjoining a residence immediately, or a temporary sojourn as often as it can be arranged, at a distance from damp situations or a smoky insalubrious town.

Disease of Lungs, Bronchitis, and Pericarditis.—Three other causes of enlarged glands and, consequently, of this complaint I have enumerated; and have explained and illustrated their influence. These are disease of the lungs, bronchitis, and suppurative inflammation of the pericardium. The existence, however, of these diseases will be ascertained by symptoms peculiarly their own; and the management will be the same with that, which it would be thought right to adopt under other circumstances of the same maladies. But as in such cases of combination there must be great and manifest tendency to glandular disease, which is a token of a feeble constitution, we ought to be more cautious in the extent to which we carry our anti-inflammatory remedies. This is the only modification in the treatment which such cases require. The morbid condition of the lungs, bronchi, and pericardium must be controlled, or the glands, enlarged by contiguous irritation, will continue tumid whilst the cause of the excitement remains, and continues to exercise its influence.

Causes of Paroxysms.—Hitherto, in considering the treatment of the laryngismus stridulus, I have confined myself to a consideration of the structural diseases upon which the tendency to the paroxysms depends, modifying the application of remedies according to the cause which may have produced those pathological conditions. But to prevent, as far as in us lies, a recurrence of the attacks is also important; and, hence, it is requisite to obviate or control those causes which, acting upon such diseased conditions, are capable of exciting the paroxysms.

Strainings of the Body.—Pursuing the same order of arrangement, as that which I adopted in noticing the agency of these causes in producing the attacks, my attention will be first directed to violent strainings of the body, particularly to that kind of exertion which resolves itself into resistance to the physical restraint of injudicious clothing, or a long continued constrained position. As far, therefore, as is consistent with due attention to warmth, these children should be loosely clad. Under any circumstances they are discomfited by tight bandaging, and make ill-directed efforts to escape from bondage; but in all morbid affections of the respiratory function, compression of the chest always distresses greatly. These struggles may produce a fit of the disease; and such physical encumbrances and annoyances should, therefore, be sedulously avoided. The nurse should be directed to watch the movements of such children, to endeavour to interpret their language which is generally abundantly intelligible, and to concede their little wishes. If the child, apparently weary of the horizontal posture, tries to raise itself, or manifests a desire to be taken from its bed; if, long carried in the nurse's arms, it betrays an inclination to be put upon its feet; if, fatigued by its attempts to walk, it exhibits a wish to be again carried; if, restless and fidgety from lying in the arms or upon the lap of the nurse, it shows a disposition for more active amusement, it will struggle to gain its object; and as such struggles, again, may re-produce a paroxysm, it will be better to anticipate its occurrence by gratifying its desires.

Exercise.—All violent kinds of exercise should be discountenanced. If the child have arrived at that period of life when it is capable of running, its sports and movements must be regulated. Indulgence in those amusements, which imply vehement exertion, should be prohibited, or, like the cat with its recurrent nerve divided, as in the experiment of Le Gallois, the child may, under exertion, fall down suffocated; climbing, too, an amusement to which children are much addicted, is peculiarly hazardous. It must refrain from the buoyant sports of childhood, though regular walking

exercise in the open air is useful. This complaint constitutes one of the few exceptions to the superiority of the wild and unrestrained pastimes of children over the sober and demure carriage of the regular school-walk. But this complaint is infinitely more common at that earlier age, when children are still in the nurse's arms, and when the only exercise, they can have, consists in movement by the nurse. "They should be carried, and occasionally tossed up and down in the arms, yet in the most gentle and cautious manner. Such an agitation affords them very agreeable sensations, whilst it promotes digestion and preserves their vivacity."⁷ But all violent jerks of the body, and throwing the child in the air, should be prohibited; for children, under such circumstances, have evidently a consciousness of danger, as is shown in their vigorous efforts to save themselves; and, during these struggles, as in the case of Sir Charles Bell's very apt illustration of the sailor, the infant closes the glottis and holds its breath to prepare for the exertion.

Fretting.—By this I have already assumed must be meant positive and somewhat violent weeping. It has been often said, that no child would cry unless in pain, discomfiture, or fright. Nurses generally conclude from the child's cries, that it wants food, which is, then, their sovereign remedy; or that it is griped, when they drug the child with pernicious compounds. Both impressions, however, are often erroneous; and the means, therefore, very commonly hurtful to the child. Nay, the constant alternation of doses of food and physic only aggravates the distress. "We get on much better now the monthly nurse is gone," said a lady to me on the very day upon which I am writing, (Nov. 20.) "Whenever the child cried, she would, in spite of my remonstrance, bring it to me to be nursed; but now, it will go two or three hours in the course of the day, and will sleep from four to six hours through the night without the breast." This, in fact, may at a very early period of infantile life be taught to the child; and in this we have often the very best test of a good nurse, who well knows that a child may cry from several other causes

⁷ Struve.

besides hunger. Frequently its cries are excited by a constrained and, consequently, irksome position, by tight swathing, by a pin pricking or scratching the child in its movements, or by the discomfiture of soiled napkins; and, under such circumstances, the remedies are obvious and efficient, and will immediately suggest themselves to a judicious attendant. But, whatever may be the cause of the child's screams, that cause should be removed, even at the expense of largely interfering with the moral discipline of the nursery; less harm arising from humouring the child even to "spoiling," than from the recurrence of paroxysms, which crying may produce, and any one of which may be fatal.

Cough.—Paroxysmal cough occasionally attends this disease, and may even constitute part and parcel of the malady; but it may be also, indirectly, the cause of a paroxysm by enlarging the sphere of movement of the arytaenoid cartilages, and thus bringing from time to time their edges so closely in apposition, that the enfeebled opening muscles of the glottis performing their function imperfectly, the chink remains, for a time, partially closed, and crowing is the consequence. It is, moreover, sometimes nature's mode of affording temporary relief. But, whether such a cough be a concomitant, consequence, cause, or cure, still it is of frequent occurrence, and the terms, in which it is described by the parents and friends, sufficiently attest its severity. It is represented by them as "like croup or whooping-cough," as "coming in fits enough to choke the child," as "suffocating," or as "strangling," and we have seen it mistaken by a highly accomplished physician for whooping-cough. It is in itself, therefore, an evil of no trifling magnitude; but, as by its tendency to hurry and embarrass respiration, it is peculiarly apt to produce a recurrence of the paroxysms of breathlessness and crowing,—especially when the bronchial glands are the seat of the disease,—it is an object of moment to tranquillize a cough, which, even if not attended with such consequences, must injuriously shake or compress parts already in a diseased condition.

It is with a view to relieve the disposition to this occurrence, at once a symptom and a cause, that I have been in the habit

of employing medicines from the tribe of narcotics in this complaint; and under such circumstances, either administered internally or externally applied, they are valuable auxiliaries in our attack upon the disease. Others have had recourse to them in the supposition or belief that this complaint was essentially of a convulsive character. In a brief communication with which I have been favoured by Dr. Merriman, he says, "Since I re-edited Underwood, my experience has, upon the whole, confirmed me in the opinion that alkalies are useful remedies in the treatment of this complaint; but I now use sedatives, conium, hyosciamus, and opium, after opening the bowels, more freely than formerly, unless there be evidence of determination of blood to the head; and I often give small doses of ipecacuan."

The object, with which I use narcotics, being to allay this cough by diminishing the susceptibility to action from slight stimuli of the upper edge of the rima glottidis, which has its nervous energy unimpaired, I prefer such of those remedies as neither disturb the sensorial function, nor confine the bowels. Conium is one which has been much and deservedly commended in all cases of spasmodic cough, including pertussis; Underwood also has enumerated "*cicuta*" amongst the anti-spasmodics which he recommends for the cure of this "extraordinary spasm;" and we have seen that it is in the very simple *armamentarium* of my friend Dr. Merriman. I have frequently employed it, and, as I think, with considerable advantage. Hyosciamus is a remedy of the same class, and, perhaps, rather more powerful in its effects than conium. Similar in virtue, but of minor efficacy, are the extracts of the lettuce and of the potatoe; but the hop, as combining a sedative and tonic influence, is the remedy of this class, which, upon the whole, I have been most frequently in the habit of employing.

As to the internal administration, in any of its forms, of opium in this disease, I have little experience of either its virtues or its vices. I rarely employ it. Nothing, however, can be more clear in conception, or less ambiguous in expression, than the restrictions enforced by Dr. Clarke with respect to

the employment of this remedy in attacks of *convulsions*, of the nature of which he believed this malady to partake; and, as they embody my own sentiments upon the subject, I cannot refrain from quoting them. "It requires," he says, "the greatest consideration, and the exercise of great circumspection, to determine when, and in what quantity, opium may with propriety be exhibited in convulsions. It may fairly, however, be laid down as an axiom, that it should never be employed on any account, until it is clearly ascertained that no danger is likely to arise from pressure on the brain, that there is not any existing inflammation of that organ, and never until the bowels have been completely unloaded, lest the stupor, arising from a compressed brain, should be imputed to opium, and the time, when alone relief could have been given in inflammation of the brain, should be allowed to pass by, never to be recalled. When the medical attendant has reason to believe that no danger is to be apprehended from any of these circumstances, opium in small doses, cautiously repeated, may be administered with advantage: and it will sometimes diminish pain by lessening the sensibility and irritability of the patient. Great care must, however, be taken, during the use of it, to keep the intestinal canal free."⁸

With the above limitations, therefore, although I generally prefer the milder narcotics I have mentioned, I sometimes have recourse to opium, more especially when, in addition to cough and restlessness, I have to combat either griping pains, or diarrhœa from an irritable condition of the bowels, whether induced by undigested and acrid matters in the canal, or, as I have had frequent reason to suspect, from the unnecessary and, therefore, injudicious severity of discipline to which the child, from erroneous impressions as to the essential character of the ailment, has been with little discrimination subjected. In these cases, where there is ground for suspicion that reiterated doses of calomel and other drastic purges have occasioned this abdominal pain and disturbance, as well as in those instances, in which there are frequent evacuations, without con-

⁸ Commentaries, p. 108.

siderable, if any, morbid state of the secretions, moderate opiates are useful. Mr. North has suggested, rather, however, in the modest form of a query than a direct recommendation, whether the black drop, Battley's sedative liquor, or the acetate of morphine, might not deserve a trial when "urged by the importunities of friends" we may be desirous of trying "to relieve the spasmodic and difficult breathing, which forms the principal and most distressing character of the affection, when other narcotics are deemed inadmissible, and when we are principally restrained from the use of such remedies in children in consequence of the cerebral disturbance they are so apt to produce. It is a well known fact, however, and one which has often been impressed upon my attention by actual observation, that adults will frequently derive the most soothing effects, and many hours of tranquil sleep, from the above preparations, who cannot bear any dose of common opium without suffering considerable head-ache and great restlessness." ⁹ The arguments here founded on the importunities of relatives is, of course, untenable; and the selection of the precise form of opiate should depend upon the object to be attained. If want of rest be the prominent symptom to be controlled, or if it be the cough which particularly demands means for its relief, the suggestions of Mr. North are well worthy of attention; but to allay pain in the alimentary canal, and especially if there be diarrhœa, opium still retaining in its composition its "narcotine" has generally appeared to me to be preferable. In these cases of intestinal pain and inordinate action of the bowels, from an excited condition of its mucous lining and muscular apparatus, the soothing influence of emollient glisters may aid the effect of the opiate and, at the same time, obviate injurious accumulation in the canal. They are fomentations to an excited part; at the same time they remove sources of irritation, and often prevent the necessity of giving purgatives by the mouth.

Even when our fears or other circumstances preclude the exhibition of opium internally, I have seen opiate glysters of great utility, and friction externally, with embrocations com-

⁹ North, on Convulsions, p. 279.

bining stimulant and sedative properties, has tranquillized, in young children, not only the cough, but the whole system. Some, indeed, have smiled incredulously at this proposal to quiet an irritable state of the respiratory and nervous systems by the outward application of opium. But, even in the adult, rags dipped in laudanum, or an opium plaister applied to the stomach, has been known to relieve the vomiting of pregnancy : “ in some cases of habitual costiveness a liniment, consisting of liniment. saponis comp. \mathfrak{z} i ; tinct. aloes com. \mathfrak{z} ss, rubbed over the abdomen every day for five or ten minutes, has been found very beneficial in keeping the bowels regular ;”¹ it is familiarly known in the West Indies that rubbing the belly of children with castor oil will purge ; and other remedies, as iodine and mercury, are employed in the same way. Analogy, therefore, would justify some confidence in this mode of practice in the delicate and vascular skins of infants, and experience amply confirms what analogy would thus suggest. It may be sufficient to mention one striking illustration, which is conclusive as to the power of an opiate so administered. The infant child of a tradesman in North Audley-street had an irritable spasmodic cough, which greatly interrupted its rest and much resembled hooping-cough in every thing but the absence of the sonorous inspiration and of the disposition to dislodge the contents of the stomach at the termination of the paroxysm. For this I directed a simple saline with a little antimonial wine, and an embrocation of the linimentum ammoniæ subcarbonatis combined with laudanum, in the proportion of twelve drachms of the former to two of the latter. On the following morning a very respectable general practitioner in the neighbourhood was summoned to this child, whom he found in a state of torpor approaching, as he thought, to coma from pressure upon the brain. He called, therefore, upon me to desire my sanction, without which the friends would not consent to his employing them, to employ leeches and some other very active remedies. It was clear that he was confounding the stupor of opium with compression of brain, to the latter of which he referred the symptoms. I saw the child soon

¹ Merriman in Underwood, p. 146.

after, and found it obviously under the influence of opium. It had been asleep without intermission for sixteen hours; and, during the next sixteen hours, it could scarcely be aroused even once to take the breast, and then very imperfectly. When, at the end of a little more than six and thirty hours, the child had nearly recovered from the influence of this powerful agent, the cough had all but disappeared. This was, indeed, an excessive effect, and such as I have not again witnessed; but, in a less degree, I have repeatedly seen a similar consequence from the same proportions either of a camphorated, or ammoniated liniment and laudanum. I have no hesitation, therefore, in advising the employment of this remedy in cases where there is great fretfulness, restlessness, abdominal pain, diarrhœa, or cough; and to relieve these, where they exist, is the sole object with which I employ any of the preparations of opium in this complaint.

It is right for me here to state that others have recommended embrocations, and even sometimes combined with laudanum. Thus Professor Hamilton directs "some stimulant substance to be rubbed every six hours on the outside of the throat;"² and Mr. North alleges that "in some cases where the convulsive breathing and violent action of the diaphragm were very great, friction upon the chest with a liniment, composed of laudanum, spirits of camphor, and soap liniment, three or four times a day has certainly proved useful."³ But the purpose of their employment has not been very accurately defined by these eminent writers. As far, however, as can be collected from their statements, I should infer that they would ascribe the beneficial effect of the remedy to the cure of the spasmodic affection of the glottis, upon which they believe the disease to depend, rather than to the relief of certain contingent events, which occur in the progress of the malady and, either directly or indirectly, influence the recurrence of the paroxysms. It is to the latter object that I almost exclusively restrict their use: adding however, occasionally, friction with the unguentum hydriodatis potassæ over the course of

² Hints, &c. p. 302.

³ On Convulsions, p. 280.

the glandulæ concatenatæ, where these are indolently enlarged, to promote their dispersion.

Abdominal distention.—It was remarked by Underwood, that the attacks of this disease may be “induced by sucking or feeding;” by Dr. Clarke, that “they very commonly take place after a full meal;” and by Dr. Millar, that in “the asthma the body was generally costive, and the stomach and bowels were often very much inflated.” These are causes and illustrations of the distention of the alimentary canal, and of its effect in producing the paroxysms of this disease. Such distention, I have already shown, embarrasses the respiratory function, and consequently enlarges the sphere of movement of the arytenoid cartilages; whilst the glands of the neck or thorax, enlarged and probably indurated, compress and enfeeble, if they do not paralyse, the recurrent nerves in their course, and thus interrupt the harmonious and consentaneous, though alternate, actions of their antagonist muscles. The glottis is, in consequence, more completely closed than in ordinary respiration, and remains so for want of sufficient power in the opening muscles to overcome this greater extent of action of the closing muscles of that chink. I may add that the pain, which is apt to be thus engendered by such distention, will, moreover, excite fits of screaming and frequent straining, both of which are amongst the most frequent causes of paroxysms in this complaint. Hence the necessity of regulating the diet, to which I have already addressed myself somewhat at large. The stomach should never be allowed to be overcharged; and, if the child have not yet learned to adhere to the golden rule, too little attended to even in after-life, of “leaving off with an appetite,” the ordering of this matter must be left to the nurse or the relatives.

Many of the internal remedies, suggested for the cure of this disease, exercise their beneficial agency by counteracting this distention, which may be either from feculent or flatulent accumulation. If constipation prevail, the propriety of employing mild but efficient aperients is unquestionable. Dr. Merriman assures us, that “if timely attended to, the complaint commonly yields to daily aperients so as to produce at

least two copious motions ; and continued doses of soda, or an infusion of burnt sponge, with proper attention to diet and regimen." I wish I could speak in the same tone of confidence of the almost universal efficacy of these remedies, employed to the exclusion of others ; but, although they occasionally fail, it is impossible not to assent most cordially to the propriety of enforcing the employment of aperients, to the extent, at least, of preventing accumulation in the bowels. We thus obviate one of the causes of the paroxysms, and prevent other ulterior evil consequences. The contents of the canal would, from remora, become acrid and irritating, and, unless removed, add to the catalogue of evils those of flatulency.

It is well known that parts, whose ordinary functions are impaired by any decided diminution of nervous energy, are still susceptible of vascular irritation and inflammation, whilst their restorative power is essentially diminished. This is strikingly the case in paralysis of the bladder from destructive disease, solution of continuity, or violent compression of the spinal marrow. Such is occasionally also the condition of the upper part of the intestinal tube. In those instances of this disease in which the par vagum is implicated, the first in the series of changes in the digestive process is interrupted. The food is not even converted into chyme. Milk, therefore, passes through the canal curdled ; potatoes, altogether undigested, are seen in the evacuations ; and the stomach is "inflated" from the contractile power of its muscular apparatus being diminished. In such cases irritation, once excited, is apt to go on for a considerable time without notice, in consequence of the sensibility being also impaired, until contiguous textures become implicated. If, therefore, such undigested and stimulant materials be allowed to linger in the alimentary tube, the mucous membrane may be excited to the production of slimy motions sometimes streaked with blood, infantile remittent fever, enlargement of the mesenteric glands leading remotely to marasmus, and even, occasionally, ulceration of this mucous lining of the intestinal canal.

In the present day, when it is the fashion to refer so many

and such diversified diseases to digestive disorder, there is, upon the whole, little fear of the practitioner omitting to keep the bowels clear. Accordingly, almost all practitioners agree in their opinion as to the necessity of giving purgatives, howsoever they may vary in the principle by which their practice is guided. Some purge to relieve the brain, which they believe to be the peccant organ, and, for this purpose, they employ gigantic doses of calomel to be "worked off by saline cathartics," that they may solicit blood from the head and, by the increase of secretion which they create, establish a copious drain from the circulating mass; others, entertaining the same vague notion of the pathology of this disease, use enormous and reiterated doses of the same potent medicinal agent without "working it off," that they may excite irritation along the whole course of the canal, until numerous slimy stools escape, by which, it is thought, are gained the two important objects of draining the blood vessels, and of producing counter-irritation over a very extensive surface—a sort of blister many yards in extent; whilst others recommend calomel, in large and repeated doses, with a view to its direct mercurial effect, or on account of some anti-inflammatory influence, which it is supposed to exercise; or because of its supposed virtues in promoting absorption; or upon the vague and indefinite notion that it may do good, one knows not how, in counteracting some ill-defined morbid condition which may otherwise prove fatal; because, in short, to borrow the quaint but emphatic language of a friend, who, were I to name him, would be acknowledged to be amongst our soundest practical pathologists, it is requisite with some vigorous remedy "to gallop after the disease."

But in this complaint, such serious results follow from the indiscriminate employment of this acrid mercurial, that I cannot too strongly deprecate, in every stage of the progressive disturbance of the digestive organs already adverted to, those herculean doses of calomel which it is the pride and boast of some practitioners to employ. These aggravate the irritation of the mucous membrane, till that, which was simply functional excitement, advances to actual inflammation, leading to its

frequent result, upon mucous surfaces, a state of ulceration, the existence of which upon some occasions dissection has demonstratively proved. At all events, they have a great tendency to induce griping, and, as the child then cries violently from the suffering it endures, the fits of threatening suffocation will be at once more frequent and more violent; for there are few causes more apt to renew the paroxysms of this complaint than vehement crying, whether from pain or passion.

In the administration of aperients in this disease the object of the practitioner should be to obviate accumulation and its consequent distention, whether from undigested or feculent matters, or from flatulency; and the mildest means, provided they are effectual, are the best. Saline purgatives are not generally desirable, as, in clearing the canal of its contents, they establish a weakening drain upon a constitution already too much enfeebled. Resinous and other drastic purgatives are equally objectionable on account of their griping properties, which, causing "sudden waking," fretting," and "crying," cannot fail to add to the frequency of the attacks. Castor oil, if not so obnoxious to the palate as to be immediately rejected, or to the stomach from its indigestible character as to sicken the child, is often mild and efficient. Rhubarb, either in substance or infusion, is little weakening, and has the advantage of admitting ready combination with such other medicinal agents as the circumstances of the case may require. Thus, if whitish, clay-coloured, and offensive stools manifest defect or disorder of the biliary and other secretions, mild alterative doses of a mercurial with very minute doses, (from the sixteenth to the eighth of a grain,) of ipecacuanha, may be given with advantage; if acidity prevail, in combination with torpor of the bowels, magnesia constitutes a valuable addition; if without constipation, it were better to substitute the fixed alkalies, as potass in its various forms, or soda which is still more frequently recommended; these will neutralize the acid, and thus afford, at least, temporary relief. If, from the acrid substances detained in the intestines, acidity be combined with an irritable state of the

canal, whilst it is advisable to wash out the lower bowels from time to time by soothing emollient glysters, we shall do well to combine with our other remedies either the chalk mixture or some of the other pharmaceutical preparations of lime, whether phosphates or carbonates, which are in common use. They absorb acidity, and produce an astringent influence.

The fermentation of undigested food in these cases is apt to engender flatulency, by far the most frequent cause of abdominal distention; the stomach and bowels are inflated. This fermentation is much interrupted by alkalies, especially soda, in which Merriman and, perhaps, the profession at large have the greatest confidence. But it is not enough thus to attempt to neutralize the acid, and to check, for a while, the fermenting process. Flatus will still be generated in the intervals between our doses; and hence it is, that "volatiles and foetids," which assist in the discharge of this accumulated flatus, are so often useful. These were the remedies so much commended by Underwood, who, considering this disease, which he comprehends under the very general denomination of inward fits, as "a spasm in the stomach, lungs, or other vital organ,"³ adds, that he had "hitherto, at least, succeeded in removing this extraordinary spasm, in every instance, by treating it, as before hinted, as a chronical croup, by administering different antispasmodics; assafoetida, ol. succini, tinct. fuligin. musk, or cicuta being prescribed, as circumstances have indicated." He further states that he had only known two fatal cases of the disease, and that these were in members of the same family. The last of the remedies above suggested—hemlock—has by some continental writers been much commended for the cure of scrofula; and, if it had power in the cure of that malady, would be, consequently, useful in a considerable proportion of cases of laryngismus, which has so intimate an alliance with a strumous habit. In this country, however, we place no reliance upon its anti-scrofulous virtues, but it is useful to procure rest and appease cough; and, as to the other remedies thus enumerated by

³ Underwood. Merriman's edition, p. 139.

Underwood, they are just means for stimulating the stomach and bowels to the expulsion of their accumulated flatus, which, by embarrassing the breathing, produces the paroxysms. These medicinal agents, therefore, have been sometimes useful, though not so frequently employed for the purpose as the bi-carbonate of soda, the alkali of which combines with the acid, whilst the carbonic acid, then extricated, stimulates the muscular apparatus of the canal; or the spiritus ammoniæ aromaticus—sal volatile—which combines the same properties in a still more efficient degree; or Dalby's carminative, (the essential ingredients of which are said to be magnesia, assafœtida, and opium,)—a popular remedy and much recommended in this complaint by both Underwood and Hamilton; or Godfrey's cordial, a strong spirit; or gin amongst the lower classes of English, whiskey amongst our Scotch and Irish neighbours, according to the national fondness for, and faith in these remedies,—all of which are calculated to expel flatus, and thus relieve "windy complaints." Amongst these remedies, which have the power of relieving flatulency, the strongest and most unequivocal testimony has been given in favour of assafœtida, which was Miller's principal remedy for the cure of this complaint, was at one time considered by Rush to be universally efficacious, and has since that period been very extensively employed, either as a constituent of Dalby's carminative, or in some pharmaceutical form as the *mistura assafœtidæ* or the *spiritus ammoniæ fœtidus*, the proportions of which are better known, and their influence, therefore, better estimated. Other remedies also ycleped antispasmodics, said to be, and probably in reality, useful in this disease, act in the same way; and amongst these it may be sufficient to enumerate the various aromatic waters or spirits, as of carui, dill-seed, cinnamon, peppermint, aniseed, pennyroyal, or pimenta, all of which are occasionally employed both by the profession and, often, by the nurses without professional sanction, either singly or in combination with other remedies. More active medicines, however, of the same kind, in addition to those I have noticed, are the *spiritus ammoniæ succinatus* and the *tinctura valerianæ ammoniata*, the latter being a very

favourite remedy with the eminent professor of midwifery in Edinburgh; and, notwithstanding the sneer of the late Dr. Clarke against "all the farago of popular medicines, such as fit drops, soot drops, assafoetida, &c."⁴ are beyond all question beneficial in those cases of flatulent accumulation, for which alone, I think, they are required. Their virtue, as antispasmodics, is very problematical.

If the stomach or temper of the child be so irritable as to reject or refuse all internal medicines, we shall probably only renew the attacks by attempting to enforce their administration; and we must, then, content ourselves with the employment of the same or similar remedies in the form of glyster; or camphor, as recommended in some cases by Hamilton,⁵ or, where the distention is extreme, even turpentine may be used, in the form of injection, with advantage.

For the same purpose of relieving flatulency, as well as pain from intestinal spasm, it is generally agreed that friction of the abdomen, with the warm hand or with flannel, and either with or without a stimulant embrocation has occasionally proved useful. The addition of a liniment has this, at least, in its favour, that it will secure more sedulous and efficient rubbing by the nurse; and, perhaps, that suggested by Dr. Meriman may have the additional advantage of tending to overcome habitual constipation.

Sudden awaking.—There has been much discrepancy of opinion with regard to the connexion subsisting between the waking of the child from its slumbers, and the occurrence of paroxysms in this disease. That the attacks, at the commencement of the complaint, are particularly apt to occur in the night, has been noticed by almost every writer upon the disease; some asserting that the attack commences during sleep, and consequently that it awakens the child;⁶ others that it occurs immediately upon waking, though before the time of waking, the child had been lying in a most tranquil state;⁷ others, again, that it is the peculiarity in the mode of

⁴ Comment. p. 89.

⁵ Hints, &c. App. p. 411.

⁶ Millar, Rush, Capuron, Underwood, and Gervino.

⁷ Clarke.

waking that occasions the fit.⁸ I have already expressed my belief that, generally, it is the attack which awakens the child, rather than the waking of the child which occasions the fit; and, consequently, so far from its being injurious to awaken the infant, this will upon some occasions obviate the occurrence of a paroxysm. This was not unknown to Underwood, who says,⁹ "these symptoms are said frequently to attack the child in its sleep, and in their commencement will go off upon taking it up from its cradle;" an observation which I have had repeated opportunities of verifying in practice. Parents, whose anxiety makes them accurate observers, having themselves noticed the attacks to be preceded by a mucous rattle in the throat, have, though uninstructed upon the point, awakened the child when the "wheezing" has become prominently marked, and have thus succeeded in interrupting a series of events, which, when allowed to continue, had always ended in a paroxysm. Upon removing the child from its bed, in these cases, the mucus, in the erect posture, gravitating from the half-paralysed trachea towards the still sensitive bronchial cells, either excites a moderate cough for its expulsion or is sometimes ejected by the subsidiary agency of deglutition. Had sleep continued the phlegm would have gone on to increase, until both extremities of the air tube had become embarrassed and excited. The cells being clogged and

⁸ North. The statements of Mr. North upon this point, which are, however, not altogether free from ambiguity, would seem to imply a belief that sometimes the one relation obtains, sometimes the other. In the commencement of the chapter it is said that the attack begins "when the child wakes from its sleep," (p. 255,) or "at the moment of waking;" p. (256;) but it is subsequently stated that the child "almost invariably awakens from its slumbers with a convulsive paroxysm;" (p. 259;) that, "after the more severe symptoms have passed off, we shall still find the child rising from its sleep with short and convulsive breathing and with an appearance of much agitation;" (p. 281;) and, lastly, that he has "known the attack return with all its original severity in consequence of the child being suddenly awakened either by accidental noise or the imprudence of the nurse." (p. 281) In the first and second of the passages, here referred to, the fit is represented as immediately *succeeding* to the waking; in the third, they appear as mere simultaneous occurrences; the fourth seems to imply that the paroxysm has preceded the waking; and in the interpretation of the last there can be "no mistake;" the fit is ascribed to the mode of wakening.

⁹ P. 140.

irritated would then obstruct and hurry the respiratory function; the glottis, which derives its energy from another source, retaining unimpaired its sensibility and the contractile power of its closing muscles, would be also excited by the mucus brought, during expiration, to that highly sensitive chink; and this, contracting upon the phlegm now an extraneous and irritating substance, would occasion a paroxysm from want of power in the antagonist muscles to re-open this entrance to the windpipe. Under such circumstances, therefore, of threatened attack from accumulated mucus, the practice of gently rousing the child from its sleep is consonant with reason, and sanctioned by experience.

But it is more than probable that injudicious waking, as by sudden noise or violence, may also excite a paroxysm, and this by the mental agitation which it occasions. Even "transient surprise" is said to suffice for the production of attacks of this complaint; and, if this be true, it is easy to comprehend that they may be occasioned by such more violent mental impressions. It is thus that fearful dreams, allied, perhaps, to nightmare, with which Gardien associates and confounds this malady, or waking it with heedless and hasty violence—implying at the same time physical annoyance—may terrify the child, and induce a paroxysm.¹ But, whatever may be the nature of the relation between these events, if any intelligible reason can be given why the child should be awakened at all, there is, at all events, abundant reason for enforcing the practical precept, that "it is of consequence that every child who has suffered from this malady should be roused from its sleep with gentleness and caution."²

Cold to the surface.—The shock produced by imprudently sluicing, with cold water, any considerable portion of the sensitive surface of a child, prone to this disease, has sometimes

¹ "They are observed to be induced by sucking or feeding, and to be increased upon any little exertion of body or transient surprise."—*Underwood*, p. 140. "L'attaque est toujours produite, dans les premières années de la vie par quelque affection morale ou vive émotion de l'âme."—*Capuron*, p. 438. "The child is most frequently awakened by frightful dreams with such a difficulty of breathing, that he seems almost suffocated."—*Gervino, on the Diseases of Children*, p. 263.

² North, p. 232.

excited a paroxysm by occasioning an unexpected gasp. This, in character, much resembles sobbing; both consisting in a very rapid inspiration, interrupted by forcible and involuntary constriction of the glottis. Something similar, though commonly in a less degree, is occasionally observed from violent alternations of hot and cold air. The nurse, therefore, should be peremptorily directed always to wash in tepid water an infant, which is, or has recently been, subject to this complaint, and exposure to all extreme vicissitudes of even atmospheric temperature should be cautiously avoided.

Swallowing.—When paroxysms of this malady are induced by “sucking or feeding,” as noticed by Underwood, Hamilton, Marsh, and Robertson, we must, since we are not justified in starving the child to cure the disease, still incur the ordinary risk from swallowing. Great caution should, however, be inculcated as to the frequency and extent of each meal, and with regard to the quantity poured into the mouth at a time. The less frequently a child is fed, consistently with the maintenance of health, the less frequent will be the recurrence of danger from deglutition. If the infant be still at the breast, it should not be suckled oftener than every three, or even every four hours, provided the child can be amused in the interval; but if it persist in crying violently, and will be appeased by nothing but the breast, we must choose the lesser of two evils and allow it food; for violent screaming will produce an attack with greater certainty, than the mere effort to swallow. The extent of each meal also requires attention to those rules which I have already endeavoured to define, for the paroxysms “very commonly take place after a full meal.” The injurious effects of this I have before noticed with considerable minuteness of detail; and against the danger from this very common cause a judicious nurse will endeavour to secure the child, by taking especial care never to overload its stomach. Lastly, with reference to the quantity poured into the mouth at a time:—if the child be incessantly plied with a continuous stream of food, then, during the effort to breathe, or, perhaps, to cry, (either of

which implies the opening of the rima glottidis for the purpose,) a small quantity may slip into the chink, and there, acting as an extraneous substance, it will by its direct influence stimulate to contraction the closing muscles of the glottis and cause an approximation of its sides, which the enfeebled condition of its opening muscles prevents their efficiently counteracting. A paroxysm will be the result; the risk of which, however, will be much diminished, and other important collateral advantages gained, if the child be always so fed as to get its aliment by the effort intended by nature to obviate these evils,—that of suction.

TREATMENT OF THE PAROXYSM.

It is not enough to employ remedies in the intervals to prevent a recurrence of the paroxysms, although this is all-important, as it includes the remedies for the permanent cure of the complaint. It is further requisite to be prepared with measures for shortening the duration of each attack. The practitioner may not, indeed, have an opportunity of being present to superintend the application of the proper means for this purpose, and for thus insuring the immediate, though temporary, safety of the child: but it is his duty to put the nurse and the friends in possession of those remedial agents, which offer the fairest prospect of success.

When the child is in what is called “a fit;” when there is a sudden and total interruption to the breathing, and the struggles for its recovery are vehement and protracted, the analogy of asphyxia from other causes would lead to the recommendation of applying warmth to the surface. M. Gervino assures us, that “by the application³ of some warm linen to the breast the paroxysm will presently subside, the child will go to sleep again, and awake the following morning as healthy as he was before.”³ But a warm bath is the most efficient mode of employing this remedy, and it should, therefore, be kept in constant readiness, that it may be had recourse to immediately upon the recurrence of a paroxysm. The child should remain in the water during the whole of the attack,

³ On the Diseases of Children, p. 263.

and at all events for the space of ten minutes or a quarter of an hour. If the temperature can be accurately ascertained in the hurry and bustle of the moment, it should be about 98° ; but, as this is not always practicable, it may be a sufficient test of a proper degree of heat, that the water conveys to the hand of the attendant a distinct sensation of warmth. This remedy stimulates both the sanguiferous and respiratory systems to more vigorous efforts, and is, therefore, useful; but it also aids materially the influence of other remedies.

Whatever can excite the respiratory muscles to more active exertion, should be recommended. It may, perhaps, appear strange to suggest a remedy, which produces the same hurried and short inspiration, or series of such inspirations interrupted by sudden closing of the glottis as, it has been seen, will sometimes produce a paroxysm. But as even a very brief and imperfect inspiration is infinitely better than none, if we can only produce a gasp or sobbing inspiration, we shall cut short the attack; for the lungs having thus received an additional column of air, the expiratory muscles will act with more energy, and, forcing the air back again by the lengthened and rather forcible expiration which succeeds a gasp or sob, will open again that chink for the re-establishment of respiration.

Few things have more power in thus producing a gasping, or sobbing inspiration, than cold suddenly applied to the face, whilst the child yet remains in the warm bath; this is succeeded simply by a lengthened expiration, and this again, commonly, by a scream, which, like all expiratory efforts, puts a stop to the paroxysm. This, therefore, although it appears harsh to the by-standers, should not be omitted.

It is useful, also, to apply stimulants to the very entrance of the respiratory tube,—the nostrils. Of these, the most powerful is ammonia. A strong “smelling-bottle” should be, therefore, always at hand; its pungency produces a gasp or hurried inspiration similar to that produced by dashing the face with cold water, followed by the same consequences. With the same view of stimulating the pituitary membrane of the nose I have sometimes used snuff, which first excites the

inspiratory muscles to draw in air, that by a subsequent explosive expiration—sneezing—the irritating substance may be ejected from the nostrils.

Vomiting also implies, in the first instance, a deep inspiration; but, in the actual effort to vomit, the expiratory muscles are in vigorous action, and the rejection of the contents of the stomach is always attended or immediately followed by an explosive expiration, brief but effectual; and this is sufficient to re-open the glottis. The pharynx should, therefore, be irritated by a feather or a finger, the application of which is easy, as the child has generally its mouth widely extended in its struggles for breath; and if, in employing either, the edge of the sensible glottis should be accidentally excited so as to produce cough, it is just an important additional advantage gained; for this is one of nature's remedies for curing the fit.

The nurse, also, to save the infant from "impending suffocation," the danger of which her untutored senses enables her to apprehend, generally pats the child strongly upon the back, or shakes it violently, and, upon one occasion, a nurse, who doated upon the child intrusted to her care, told me that nothing but the well-timed absence of the mother could have enabled her to venture upon the severe shaking and slapping, amounting to positive mechanical violence, which she thought it necessary to employ, and to which she ascribed the resuscitation of the infant. The attendant, however, although she sees the ultimate result, comprehends little of the principle involved in this treatment, which is nothing more than that of causing the child to *cry*—another explosive expiration which opens the glottis. Friction of the chest and abdomen may, possibly, add to the efficacy of this shaking and slapping by directly stimulating the intercostal and other respiratory muscles, and may be had recourse to whilst the child remains in the warm bath; but, we cannot wait in the midst of a paroxysm for the little additional influence to be anticipated from stimulant embrocations. Such friction will, moreover, often occasion an expulsion of flatus from the stomach by an effort, in which the same agents are excited as in vomiting;

and during or immediately after the eructation, thus induced, there is commonly, as in vomiting, a brief and slightly explosive expiration, by which, as by the other forcible and audible expiratory efforts, the constriction of the glottis is removed; and it is now well known that by any one of these the paroxysm may be terminated.⁴

These forcible expirations are, in their influence, analogous to the syringe in Le Gallois' experiment, with which, when he had paralysed the opening muscles of the glottis by a division of the recurrent nerves, he could, by the exertion of a very slight power upwards from the trachea, force air through the larynx; but when he attempted to draw air downwards with the instrument, the same resistance was offered as that which would be produced by placing the finger at the extremity of the syringe.

There is one other natural action by which Millar represents the paroxysm to be sometimes relieved. This is "purging," which, it must be confessed, is neither an inspiratory nor an expiratory effort, and yet is intimately associated with both. No one can be ignorant of the extent to which the respiratory muscles are engaged in the daily office of discharging the contents of the alimentary canal. The chest is filled, the diaphragm is in a state of rigid contraction, the abdominal muscles act with vigour, and the expulsion of the intestinal contents is immediately followed by a short explosive expiration, even distinctly audible. If the chest can be thus filled for the purpose, the glottis must have been open for the admission of the column of air; or if this have not completed the cure, then, the slight expiration, attending or immediately following efficient action of the intestinal tube, forces open the glottis; this, therefore, should be also encouraged. We cannot, however, wait, in these cases, for the operation of a purgative given by the mouth; we must content ourselves with glysters, if the materials for these be at hand; and it

⁴ If the child was not speedily relieved by coughing, belching, sneezing, vomiting, or purging, the suffocation increased, and he died in the paroxysm. Millar, p. 18. At length a strong expiration takes place, a fit of crying generally succeeds, and the child evidently much exhausted often falls asleep. Clarke, p. 87.

matters little whether it be assafoetida, turpentine, or soft soap that is employed. But I have experienced little comparative advantage from these subsidiary measures, and, indeed, it must be obvious that in a case, in which either the child recovers with a crowing inspiration within two minutes, or dies suffocated in about the same space of time, a remedy, which requires *préparation*, will commonly come too late to be entitled to any credit in the cure of the paroxysm. When, however, the child is observed to strain without effect, instantaneous aid may be afforded by a measure much recommended by Underwood for the relief of habitual constipation, the introduction of some solid substance into the rectum. These suppositories,—solid *lavemens* or dry clysters, as they have been termed,—might consist, as recommended by Underwood, “of twisted paper or linen cloth moistened with oil, or a bit of Castile soap, mallow root, red beet, or a parsley stalk,” if these materials were at hand and ready prepared; but they are not. There can be no difficulty, however, with an attendant, who carries about with her a little finger, and has intellect enough to guide it. This previously greased may be introduced, pressing it upwards and backwards, and allowing it, when it has passed rather more than an inch within the rectum to bend a little forwards, so that it may accommodate itself to the slight curvature of the sacrum and of the canal which is tied to it by the meso-rectum.

Considering the more severe instances of this malady as very nearly allied in character and consequences to suffocation from mechanical obstruction of the windpipe, might it not be advantageous, should the practitioner be present at the time and find the danger imminent, to introduce, if it can be accomplished without force, a tube through the contracted glottis? or even in extreme cases to open the trachea for the admission of air within the chest? In a dog, three days old, Le Gallois having produced complete asphyxia by a division of the recurrent nerves, made an opening into the trachea “when all sensibility was upon the point of being extinguished and he made only very distant efforts to inspire. Upon the first inspiration, air rushed into the chest through the aperture, the

carotids previously black, became of a bright colour and the animal recovered without further aid." It may be said, indeed, of these cases, as M. Bourdon alleges very truly with respect to fatal asphyxia from *tiraillement* of the recurrent by an aneurism of the aorta, that "no one has yet tried tracheotomy under such circumstances;" but, surely it would be worthy of a trial in this disease under circumstances similar to those of the dog in the experiment of Le Gallois, that is, when all sensibility is upon the point of being extinguished, and the child makes only very distant efforts to inspire.⁵

In one of the cases which I have related, the mother described the veins during the fit, as "very black and showing very much," and this appearance is not uncommon, when the disease has been of long continuance. This state proves the existence of congestion in the larger branches of the external jugular veins, and implies considerable impediment to the return of blood through the lungs. It is probable that that, which thus obtains in the external, exists also in the branches of the internal jugular veins, and, therefore, that the sinuses and veins within the cranium are gorged with blood. But as the heart's action does not immediately cease in these attacks, and as the due changes of blood do not take place in the lungs, (as was ascertained by the experiments of Le Gallois and others,) it seems more than probable that the arteries, whilst they continue to act, will carry to the brain blood, which has dele-

⁵ Since the above paragraph, nearly in the form in which it now stands, was submitted to the profession in the pages of the Medical Gazette, I find from Dr. Marsh's paper, which I then had not seen, and knew only by its being mentioned in the article "Spasm of the Glottis" in the "Cyclopædia of Practical Medicine," without reference to the collection in which the original paper was to be found, that this operation has been performed with success by his friend Dr. Johnson. I have now made no essential alteration in my former statement, that the grounds upon which I was originally disposed to advocate the propriety of the operation may remain upon record, and as a proof of the value of well-conducted physiological experiments in illustrating pathological facts, and suggesting remedial expedients. It is a reply to the maudlin sensibility with regard to such experiments too prevalent at this time; and I should do an injustice to my own feelings, as well as to the merit of these enlightened practitioners, if I withheld the expression of my cordial approbation of the sound discretion and great moral energy, which dictated the employment of this last resource of our art.

terious properties, just as, in animals asphyxiated by a division of the recurrents, the carotids were seen to be carrying black blood, which became again almost instantaneously florid upon the re-establishment of respiration by making an opening into the trachea. In the instance before mentioned of the man, labouring under cynanche parotidea, who died almost instantaneously, one more imperfect effort to inspire occurred upon a minute quantity of blood flowing from the external jugular vein, which was opened by the apothecary of the establishment. May it not be useful, where the vessels are thus surcharged with black blood, to have recourse to this very simple and easy operation? The quantity taken must be inconsiderable, or life will be extinguished by it, for venous congestion, in general, neither requires nor bears such active depletion as arterial fulness and excitement: and, in this disease, I have known the child brought into imminent hazard by the exhaustion produced by a few leeches, and life unquestionably shortened by persisting in a similar practice.

Such are the practical suggestions, which I have to offer, as to the treatment of those most frequent forms of the crowing inspiration, in which the constriction of the glottis arises from injurious compression, by tumid absorbent glands, of the nerves which supply the trachea and those muscles whose office it is to open the rima glottidis, when requisite for the purpose of respiration. In the present state of our knowledge, it were too much to assert that no other cause is capable of producing this ailment by direct influence; and so general is the belief that head-affection is one of those causes, which may operate by direct agency, that it is little short of heresy to doubt it. The truth of this doctrine I have already seen reason to call in question; but it is also vague, and unsatisfactory. It is not very distinctly stated whether it is congestion, simple irritation, inflammation or pressure of the brain or its membranes, which produces the effect, or whether the same condition, be it spasm or be it palsy, obtains through both stages of the *maladie cérébrale*, as this head-affection of children has been well denominated by Cruveilhier; and, further, the doctrine affords no satisfactory explanation of the

symptoms, even if true. It does not in the least explain the fact why the par vagum should be affected to the exclusion of other nerves having their origin in the same respiratory column or passing close to them; nor why, if the glottis be closed by a spasm, the superior laryngeal branch of that nerve should be affected to the exclusion of the inferior and of those other branches, which proceed from the same common trunk; nor why, if the closing of the glottis be the result of paralysis from pressure at the origin of the respiratory nerves, the recurrents should be exclusively influenced; and still more difficult is it to account for the transfer of morbid influence from one branch of a common trunk to another, in the course of the same malady, which the phenomena would imply. The stage of inflammation of the brain is commonly attended with convulsive movements; that of effusion by paralysis extending even to the sphincters; yet, in both the crowing inspiration may occur. If this arise directly, not intermediately, from the cerebral affection, the closing of the glottis must in the inflammatory stage be convulsive from excitement of the superior laryngeal nerve, whilst the recurrent, retaining only its ordinary power, is unable to counteract the muscular spasm produced by the morbid excitement of its antagonist nerve;—in the stage of pressure from effusion, when all the functions and faculties are torpid from paralysis, the same closing can only arise from a palsy of the recurrent, the superior laryngeal nerve still retaining its powers unimpaired. Both can scarcely be simultaneously affected; for the equal contraction of antagonist muscles, upon which these nerves are respectively distributed, would probably keep the chink in its medium state, which is that of permeability to air; whilst paralysis of both would, in conformity with the experiment of Magendie, who annihilated all nervous influence in the four laryngeal branches of the par vagum by their division, cause the chink to be permanently open. Such transmutation of morbid influence from one nerve to another; or, what is infinitely more difficult to imagine, from one branch of a common trunk to another in the progress of the same disease, is all but inconceivable; and the impro-

babilities, therefore, of this opinion militate greatly against its reception. Still the opinion has maintained its ground and has exercised great influence, nor would I denounce the treatment, founded upon it, as universally improper; for such a cerebral disease may be the original, though often indirect cause of the crowing inspiration, and the primary affection must be actively treated, or the patient will fall a victim to the complaint either by general convulsions or its succeeding coma, or, sometimes, by the intermediate agency of the crowing inspiration, which is in such cases a secondary complaint. But the existence of this cerebral malady will be recognised by signs peculiarly its own, without reference to the croup-like inspiration, and the treatment will be wholly uninfluenced by its accidental combination with the laryngeal affection.

There are, however, some instances in which there has been something like external evidence of the existence of a cause capable of producing excitement in the respiratory muscles through an inflammatory condition, or other diseased structure of their nerves. An instance of this kind, of late much relied upon, is, possibly, that of Dr. Monro,⁶ which he denominates "the most acute species of hydrocephalus." The prominent occurrences in this case, positive and negative, were, a violent cough, the croup-like inspiration, great and increasing embarrassment of breathing until it became "laborious," and the absence of general convulsions or of insensibility throughout the whole course of the disease. The child sunk gradually, neither dying of convulsions, nor of the coma consequent upon cerebral disease, nor of the suffocation, the occasional result of laryngismus. There appeared, upon dissection, a "*large firm and healthy brain,*" distention of the sinuses with black blood, *transparent gelatinous effusion covering the superior part of the posterior lobes of the brain, an ounce of colourless serum in the ventricles,* "the medulla oblongata floating on a great quantity of clear serum," the "veins covering the tuber annulare and medulla oblongata distended with blood, so that they exhibited a deep scarlet colour; the origin of "the fifth

⁶ On the Morbid Anatomy of the Brain, p. 17.

and eighth pairs of a deep scarlet colour and covered with turgid vessels, a considerable quantity of serum in the upper part of the spinal canal, a turgid condition of the vessels of the spinal marrow of a vermilion red colour at the cervical portion, of a dark red hue in those of the lumbar portion; and lastly, "*the eighth pair of nerves was of a deep uniform red colour along its whole tract, as far as its branches going to the lungs.*"

There might be some ground for the inference, intended to be drawn from this case, that the inflammatory condition at the root of the fifth, and especially of the eighth pair of nerves, was the cause of the whole series of phenomena, if the attention of Professor Monro had been specifically drawn to the state of the absorbent glands of the neck and thorax, and the negative fact had been established that these were not enlarged. The connexion, however, upon which Dr. Monro so forcibly insists, of hydrocephalus with scrofula, and his opinion with regard to which he has so concisely stated and so ably supported,⁷ and especially the association to which he also adverts of the former disease with "tumours of the neck" and "enlargement of the occipital lymphatic glands,"⁸ induce me to suspect that enlargement of glands in the course of the recurrent may have occurred; and this would explain some of the leading symptoms. But, as the case at present stands, we have the striking anomaly of a pathological condition of the origin of the fifth and eighth pairs of nerves producing a certain class of symptoms, whilst the same pathological state, in a greater degree, upon the posterior lobes of the brain, within the ventricles, and within the spinal sheath produced no characteristic symptoms. There is, besides, much confusion in the attempted explanation of the symptoms, which "were probably to be imputed to the effects of *irritation* to which the laryngeal nerves had been exposed, for the *stretching* or *dividing* these nerves in a living animal produces *the same effects*;" and again, "the functions of the lungs and stomach are *suspended* from the *irritation* applied to the eighth pair of nerves, which also happens when these nerves are *divided*."⁹

⁷ P. 117, 118.⁸ P. 113.⁹ P. 79.

This confusion, into which the professor has been evidently betrayed by a note from a work of Burns,¹ (which I have already quoted as a proof of great ingenuity, though tainted with some inaccuracy,) between the effects of irritation of a given nerve upon the one hand, and of the annihilation of its energy by division upon the other, leads me to doubt the accuracy of the explanation—at least if I perfectly comprehend it, of which I am not quite certain,—and is, at the same time, an unequivocal proof of the extremely unsettled state of the opinions of the profession at large with regard to the general principles of the pathology of nerves.

The only pathological appearance in this case, described by Dr. Monro, which tends to elucidate the phenomena, is the inflammatory condition of “the whole tract of the eighth pair of nerves.” This explains, indeed, all the essential symptoms, especially the “violent cough,” the “sound like croup,” and the “great and increasing difficulty of breathing,” becoming at last “laborious.” These are, in fact, the usual symptoms of an excited condition of those nerves, whether produced by irritation with a pointed instrument as in an experiment by Cruveilhier, or by inflammation of the same nerves as ascertained by the pathological observations of Breschet and Autenrieth, corroborated by the occurrence of similar symptoms—violent convulsive cough, like whooping-cough—in a case related by Sir Astley Cooper, in which, after an operation for carotid aneurism, suppurative “inflammation extended on the outside of the sac along the par vagum nearly to the basis of the skull,”² and in one mentioned by M. Gendrin, in which the same nerves were denuded by a deep-seated abscess.

The instance before adverted to, communicated to me by Mr. Fowler, is possibly also an example of the crowing inspiration, depending upon excitement of the superior laryngeal nerve from a small tumour in one of the nervous filaments proceeding from the medulla oblongata to assist in the formation of the par vagum.

From the sonorous inspiration being the prominent symp-

¹ Principles of Midwifery, Ed. 1820, p. 717. ² Med. Chir. Trans. vol. i.

tom, and from the peculiar organic change being one which is always productive of excitement of those parts upon which the nerve affected is distributed, the inference to be drawn in this case would be, that the particular filament which had been the subject of this particular formation, was intended to form the superior laryngeal nerve, inasmuch as the muscles upon which this nerve is distributed were supposed to be in a state of spasm. But a single instance of this kind is not sufficient to warrant any general inference, involving, as this does, an anatomical fact; assumed not proved, a physiological explanation, and a pathological conclusion from the whole. The fact here depends upon the explanation for its support, instead of the explanation upon the fact; and the pathological inference, therefore, is not established by a sufficiently severe induction.³ But the case has great intrinsic interest, and deserves to be recorded, that the inferences deduced from it may be either confirmed or invalidated by future investigation.

The only practical observations, suggested by these cases, admitting the whole that is inferred from them, is this, that if there be evidence of vascular excitement and inflammation at the root of the eighth pair of nerves, by which however is generally merely meant that it is within the cranial cavity, we must by active measures subdue that cerebral excitement, whether it be accompanied or not by the croupy inspiration, and whether, if so accompanied, it produce the laryngeal affection by direct or indirect influence.

As to the inflammation of the "tract of the par vagum," the existence of this has rarely or never been ascertained during life; we may suspect it, however, where there is uneasiness about the course of the nerve, tenderness upon pressure, a violent spasmodic or convulsive cough, especially if, as in Sir Astley Cooper's case, the patient shall hoop violently, and all this without suspicion of disease of the air tubes, or any stethoscopic or other indication of disease within the chest; and in such cases

³ It is right that I should state, that Mr. Fowler, in presenting to me the preparation, did not engage in any reasoning upon the subject. He merely stated, that this was a crowing child, and that the only diseased structure he could discover, upon dissection, was this small tubercle.

we should be perhaps justified in leeching and blistering the neck, and in the use of active purges, with low diet, to control the inflammation, whilst we appease some of the consequences of the excited state of the nerve, manifested in its remote distributions, by opiates or other narcotics. But these means I suggest rather upon speculative grounds, and in conformity with general medical principles, than from any experience of such cases, which are confessedly extremely rare.

A single observation will suffice upon the subject of the tubercle of the nerve. We cannot know of its existence before death; and, if we did, it is beyond the reach of art—just as in a case of similar disease in the great phrenic nerve, which produced, by the spasmodic affection of the muscle upon which it is distributed, the symptoms of asthma, the diseased condition could only be ascertained after death, and even had it been known to exist during life, it was incurable.⁴

⁴ Descot, *Sur les affections locales des nerfs*, p. 257.

A P P E N D I X.

APPENDIX.

I. ILLUSTRATIONS OF THE GENERAL PRINCIPLES OF THE PATHOLOGY OF NERVES.

IN the preceding "Essay" it has been shown that the laryngismus stridulus, or crowing inspiration of infants, is generally, if not universally, owing to morbid enlargement of the thoracic or cervical absorbent glands, and that these operate in the production of the disease by their injurious agency upon certain nerves, which have an essential connexion with the respiratory function, and exercise a direct influence upon the movements of the glottis.

In the progress of my inquiry into the exact nature of this influence, I found my path obstructed by the vague and unsatisfactory manner in which the very interesting subject of the pathology of nerves had been treated both in the systematic works and detached communications of writers upon the subject. The language employed by them was often ambiguous or obscure; many of their general statements appeared to be merely conjectural, and destitute of proof; the same symptoms were often referred to totally different pathological conditions of a nerve; and, not unfrequently, various and contradictory effects were ascribed to the same morbid change.

To clear up some of this obscurity, to reconcile the apparent anomalies, and to disentangle the intricacies which such different and even contradictory statements, not only of various writers but even of the same authors, and sometimes in the same chapter of the same work, had produced, I was driven to the necessity of subjecting to a more exact and rigorous examination those recorded cases, which are to us what "precedents" are to lawyers, and which alone, when duly examined, can justify the deduction of general principles, and the consequent enunciation of general propositions. I found, indeed, that the morbid appearances had been registered with great minuteness and fidelity, but no very definite or perspicuous attempt had been made to trace with accuracy the symptoms characteristic of each, although the association of the two in description must ever be the great end and object of pathological anatomy. Without such association, the record of appearances is little worth; it has about the same practical value as the mere *catalogue raisonné* of an anatomical museum.

All nosological arrangements are founded upon the resemblances and differences of the essential circumstances of diseases; upon similarity—the foundation of their being grouped together in classes and orders; upon dissimilarity—the foundation of their distinction into genera, species, and varieties. In examining these resemblances and differences in individual instances of "affections" of nerves, it appeared that the phenomena, which I was to subject to examination, manifested themselves at their remote extremities, and that like causes, operating upon the trunks of given nerves, occasioned like effects upon all their branches beyond the point where the morbid impression was made. In further tracing these phenomena, it seemed to be established that nerves erred either by excess or defect; and that each was characterised by its appropriate signs, and originated from causes exclusively productive of each.

These general facts constitute the foundation of that arrangement of the general principles connected with the pathology of nerves, which, in the essay on the laryngismus

stridulus, I thought myself justified in propounding, and the truth of which further and more extensive inquiries have tended to establish and illustrate.

But to some these general principles may appear less satisfactory than to myself, and it has been represented to me that they require the confirmation which details alone can afford them. These details, therefore, will form the subject of the following Appendix. I neither expect nor pretend to exhaust this interesting and comprehensive subject, with regard to which it is rather my purpose by inviting the attention, and stimulating the curiosity of the profession, to induce the prosecution of further inquiries. It is an extensive field of research, and will amply repay its cultivation.

It may be objected to me, perhaps, that in entering upon this subject I am trespassing upon the province of the surgeon, since these diseases are *local* in their character, produce commonly merely *local* symptoms, and require *local* and, in many instances, chirurgical means for their cure. But these maladies are upon the confines of medicine and of surgery, the boundaries of which it is not so easy, as seems to be assumed by certain collegiate and corporate bodies accurately to define; and, at all events, I may well shield myself under the example of one of our most eminent and accurate pathologists, who, himself a practical physician, has very briefly considered the subject of the pathology of nerves, at the conclusion of his valuable "Researches on the Diseases of the Brain and the Spinal Cord."¹

But, in truth, these structural maladies are not sufficiently numerous to enable any single individual, to whatsoever artificial distinction in the profession he may be attached, or to whatsoever branch of the profession he may particularly devote himself, to do justice to a subject so ample, without availing himself of the experience and observations of others; and as the stores of medical literature are open to all, it is only requisite that he, who undertakes to investigate or newly arrange the morbid affections of the nerves of the human body, should be tolerably acquainted with their structure,

¹ Dr. Abercrombie.

course, distribution, and offices, and with the phenomena of disease in general; that he should have access to the ordinary sources of information, with industry to consult them; and that his habits and pursuits should have accustomed him to the selection, arrangement, and compression of the observations of others, and to the exercise of his reasoning faculty upon the materials which he may thus be enabled to collect. How far it may have been my lot to acquire these requisites, or to apply them to the subject under consideration, it is not for me to determine. My purpose has been to simplify the arrangement and facilitate the acquisition of knowledge with regard to the diseases of these all-pervading instruments of sense and motion, rather than to add largely to the stock of information upon the subject; and if I shall have succeeded in the attainment of these objects, of no inordinate pretensions, or in even promoting discussion upon the subject, I shall consider the time and labour, which the inquiry has cost me, amply repaid.

The general principles to which I here advert are the following:—1st, That if injury or disease affect the trunk of a given nerve, the principal effects will be observed at the remote extremity of its filaments; 2ndly, that all the branches, proceeding from such common trunk, will have a similar disturbance of function from the same morbid impression; 3rdly, that the morbid affections of nerves resolve themselves into those of excitement, and those of defective energy, each presenting peculiar and definite symptoms; 4thly, that excitement may be the result of mechanical impulse, of vascular congestion and irritation, of inflammation, of structural disease, and perhaps sometimes of simple functional disorder; and 5thly, that diminished energy is generally the consequence of some extraneous pressure upon a healthy nerve, or of atrophy, either primitive or secondary, of the nerve itself.

Notwithstanding the natural and intimate connexion of these elementary principles with the subject of my foregoing inquiries, I have thought it better for reasons already explained,² to defer till the present opportunity, and to embody in a separate form the evidence, which is abundantly ample,

² Essay, p. 121.

in their support. Cautious, therefore, of the authority upon which I select my illustrations, I shall now proceed to a detailed consideration of each of these general propositions.

1. *If injury or disease affect the trunk of a given nerve, the principal effects will be observed at the remote extremities of its filaments.*

This statement involves two propositions: the one of a negative character, rather implied than expressed; the other a positive allegation:—and both requiring the evidence of facts in their support.

First, it conveys by implication that injurious impressions upon nerves do *not* produce their effects at the point where the injury is inflicted, nor at any part nearer to the *sensorium commune*; in the compressed language of a recent eloquent writer upon *tic douloureux*, “the seat of pain is not the seat of the disease.”³ This observation, however, applies only to the trunk of a nerve; but it is true in whatsoever part of its course the injury may be received, or the disease exist. If the impression be made at the remote extremity of the nerve, the effect is, at first, confined to the part injured, as where neuralgic suffering has resulted from pricking, pinching, lacerating, or cutting any part of the common integuments. This is well illustrated by Mr. Wardrop’s case of injury to the sentient extremity of the fore-finger, which was “pricked with a gooseberry thorn.”⁴ For above ten months after the infliction of the injury, the pain was confined to the two first phalanges of the wounded finger, after which, however, a new series of symptoms made their appearance. The observation, also, applies only to healthy nerves, for it is well known that disease of their texture essentially modifies the results.

Experiments upon animals, indeed, when instituted upon those fibrils of a nerve which minister only to sensation, give us little information upon this subject, as “these creatures are unable to express what they feel, and their expressions of pain may be rather from cutting surrounding sentient parts

³ Sir Henry Hallford.

⁴ Med. Chir. Trans. vol. viii.

than from the injury of the nerve; and at all events they will probably confound these sensations.”⁵ But accidents and surgical operations, which are experiments upon the human frame the least obnoxious to objection, will enable us to verify the observation. Those who are guilty of the domestic offence of napping in a chair present abundant illustrations of its truth. During sleep, under such circumstances, it is far from uncommon, (and my experiments have been numerous upon the point,) for certain nerves to be so compressed, as temporarily to annihilate their function. If the occiput rest upon the sharp edge of the back of a chair, the sentient extremities of the sub-occipital branches suffer, and the occiput is benumbed; if the arm hang over the same edge, the median or radial nerve is affected, and the fingers and thumb, which it supplies, lose their sensibility; if the part of the arm immediately above the elbow rest upon the back or arm of the chair or upon a table, the head being supported by the corresponding hand, the ulnar nerve will be influenced, and the half of the ring finger and the little finger will lose all power of sensation; whilst from long continued pressure, in sitting in one position, the sciatic is influenced and the foot paralysed. There is no peculiar sensation, in these cases, at the precise point where the nerve is pressed, nor are we conscious of the result until some little time after waking, when the effects are observable at a distance. Hence it has, with much truth, been alleged that nerves in their natural and healthful state are in themselves little sensible, and are “probably media of transmission only,”⁶ “les agens de la transmission des impressions;”⁷ and if the part, where the impression is made upon the nerve, is little sensible of that impression, *a fortiori* it may be concluded, that the parts supplied by the same nerve above that point—that is nearer to the nervous centre—cannot be cognizant of the injury or suffer from its immediate effects; “nihil patiuntur artus qui nervos habent supra sedem vinculi vulnerisque natos.”⁸

⁵ Sir Charles Bell.

⁶ Mayo.

⁷ Magendie.

⁸ Haller, Elem. Phys. iv, p. 325. Galen has well expressed the same principle founded upon similar facts: “adeo certe magna quædam vis est in nervis,

Secondly, it is made a matter of direct and positive statement, that the principal effects of injuries or diseases are observed at the remote extremity of the filaments of the nerves affected; and such is the force of habit and association in this particular, that even if the parts which they supply with nervous energy no longer exist, as in some cases of amputation, uneasy feelings are constantly referred to the lost member. The husband of one of my patients, in a *sortie* for the recovery of a superior officer, who had been taken prisoner by the enemy, lost his leg by nearly the last shot, which was fired at the conclusion of the Peninsular war. From some mechanical irritation, or more probably from chronic inflammation or other diseased condition of the nerves of the stump, he is subject to such agonizing neuralgic affection, with spasm of his remnant of a thigh, as, notwithstanding his natural cheerfulness and courageous bearing, almost to make him faint. He constantly complains of his offending leg and toes which are buried in the south of France. Similar instances are mentioned by Portal, Swan, Descot, Guthrie, and others;⁹ and they afford very unequivocal, though indirect evidence of the principle under consideration, that, when a strong impression is made upon a nerve in its course, the effects are commonly observed at its remote extremity:—"if, however, a doubt should be entertained upon this subject, an attention to symptoms will soon dispel it; when a nerve is irritated at any part between its origin and termination, a sensation is felt as if some injury were done to the part which it supplies.

superne a magno principio affluens: non enim ex seipsis eam, neque connatam habent. Cognoscere etiam potes hinc maxime, si incideris quencunque istorum nervorum, aut spinalem ipsam medullam: quantum enim superius est incisione, continuum cerebro, id quidem adhuc conservabit principii vires: omne autem quod inferius est neque sensum neque motum ulli præbere poterit. Nervi itaque rivorum in morem à cerebro, ceu ex quodam fonte deducunt musculis vires."—*De Motu Musculorum*, lib. i.

⁹ Frequentissima et antiquissima est adnotatio, si quando digitus aut pes, aut crus amputatum fuerit: in eo tamen amputato artu dolores vividos omnino percipi, ut sana, sibi que constans, anima fallatur, atque in eo artu dolorem se percipere suadeatur: qui dudum detruncatus computruit neque nunc ulla pars est nostri. Ipsam flexionem detruncati artus se percipere credebat qui truncum brachium flectebat cujus manus perierat.—*Haller, Elem. Phys.* iv. p. 305.

If, therefore, the cutaneous nerves were injured, the integuments of the fore-arm would seem to suffer pain; but if the median nerve was wounded, the thumb and two next fingers would be affected with pain.”¹

It may perhaps be somewhat difficult to reconcile this with a speculative opinion of Sir Charles Bell upon this subject, that “a pure and simple nerve has the influence propagated along it in one direction only, and not backwards and forwards: it has no reflected operation, or power retrograde; it does not act both to and from the sensorium.”² There is no doubt that the ordinary course of sensation, from the impression on the part to the conception in the sensorium, is in a direction from the extremity of the nerve to the brain; but here an impression is made upon a nerve, and sensation is experienced at a point still more distant from the brain than the seat of impression. How are these apparently conflicting statements to be reconciled? Three modes of explanation suggest themselves to my mind: first, the observation which I have quoted may refer only to muscular parts, to which Sir Charles Bell has particularly applied his principle of the nervous circle:—secondly, there may be actually no exertion of nervous energy beyond the part of the nerve upon which the injury is inflicted, although the limb and the nerve remain entire; the sensation of pain at the extremity may be a delusion, the result of those powerful principles in the physical and moral constitution of man,—habit and association,—which we have seen, in stumps, leading the patient to refer his sensations to the extremity which he has lost, even to the belief of flexion in the amputated member:—thirdly, disease may alter the results; and in most of the cases of painful affections it must be borne in mind that there is some structural disease of the nerve in its course. It is in the second and third of these modes of explanation that I have the greatest confidence. The doctrine of a “nervous circle,” the prototype and unacknowledged parent of the more recent

¹ Abernethy on the ill consequences of venesection: *Surgical Works*, vol. ii. p. 159.

² Sir C. Bell on the Nervous System, p. 232.

dogma of a "reflex function," has such foundation that it is not to be shaken by a mere difficulty. It is the philosophical expression of a very general fact, but whether liable to exceptions, and requiring, therefore, limitation and restrictions, it will require more extended observation to determine. I am free to confess that these suppositions do not altogether remove the difficulty from my mind. Conceding, however, all that may be deduced from this apparent anomaly, it remains substantially, perhaps universally, true, that "if we select a filament of a nerve, and if its office be to convey sensation, that power shall belong to it in all its course wheresoever it can be traced; and wherever in the course of that filament, whether it be in the foot, leg, thigh, spine, or brain, it may be bruised, or pricked, or injured in any way, sensation and not motion will be the result; and the perception arising from the impression will be referred to that part of the skin where the remote extremity of the filament is distributed."³

This general principle, then, as far as sensitive nerves are concerned, is abundantly established: but it is equally true of motor nerves. "*Irritato nervo convulsio in musculo oritur qui ab eo nervo ramos habet.*"⁴ "A rabbit was struck behind the ear, so as to deprive it of sensibility; and I then exposed the spinal marrow. On irritating the posterior roots of the nerve, I could perceive no motion consequent in any part of the muscular frame; but, on irritating the anterior roots of the nerve, at each touch of the forceps there was a corresponding motion of the muscles to which the nerve was distributed. Every touch of the probe or needle on the threads of this root was attended with a muscular motion, as distinct as the motion produced by touching the keys of a harpsichord."⁵ "The nerve of the fifth pair being irritated at its root in an ass, the moment it is killed, the muscles of the jaw act, and the jaw closes with a snap." "The same nerve being irritated where it lies in the sphæno-palatine fissure, the jaws came together with much force; indeed, so as to nip an assistant's finger severely;" and again, "on dividing the

³ Bell op. cit. p. 18.

⁴ Haller, Elem. Phys. iv. p. 325.

⁵ Bell, p. 31.

roots of the nerve in a living animal, the jaw fell relaxed.”⁶ These are happy illustrations of the function of the motor branch of the fifth pair of nerves, and afford conclusive evidence that the effects of injurious agents upon nerves are observable at the remote extremity of their fibres.

2.—*All the branches, proceeding from a common trunk, will have a similar disturbance of their function from the same injurious impression.*

This is unquestionably true, as a general proposition; but as there are some exceptions to the rule, it must be taken *cum grano salis*. By the expression “similar disturbance” is here meant a resemblance in kind, rather than sameness in degree. If, for instance, a nerve of sensation be excited, as some of those branches of the fifth which proceed from its ganglionic root, there will be morbid sensibility—neuralgia—in all the parts of the surface supplied by these branches, of which innumerable instances are upon record. If it be a nerve, which ministers exclusively to motion, that is excited, spasm will be the result; if a compound nerve, there will be commonly the combination of violent suffering from neuralgia with convulsive movement; and the excited state will be sometimes conveyed from the nerve originally affected to others in its vicinity, or with which it may be associated by nervous communication or interchange of filaments. So, decayed teeth have, by irritating and inflaming the nerves of the gums, occasioned painful affections and muscular spasms, not only of the face from the extension of diseased action to the sensitive branches of the fifth and the portio dura of the seventh, but also in those muscles of the neck, and even upper part of the back, which are supplied by the respiratory system of nerves. Of this the extremely interesting case recorded by Mr. Mitchell,⁷ affords a striking example.

A similar extension of diseased action was observed in a case of medullary tumour of the ham, related by Mr. Travers.⁸ In this case, the pain was at first confined to those parts upon

⁶ Bell, p. 35.

⁷ Med. Chir. Trans. vol. iv.

⁸ Ibid. vol. xvii.

which the long cutaneous branch of the peronæal nerve is distributed, as “the toes and outer side of the foot;” but afterwards the loin upon that side, together with the parts supplied by the sciatic and crural nerves, partook of the neuralgic affection, probably from the extension of inflammation upwards. It is generally the same where similar nerves are paralysed; all the parts, which derive their energy from the same trunks, will lose at once their sensibility and muscular power; but this seldom extends upwards above the part affected. The ischiatic nerve, compressed by sitting or by an aneurismal tumour, is affected with a diminution or total loss of sensibility, and of the power of muscular action in all the parts which it supplies. There is not increased sensibility in one part of its course, with diminished sensibility in another; neither is there convulsive movement in one part of its course, with defective muscular power in another. Be the state that of muscular spasm upon the one hand, or paralysis upon the other, acute pain upon the one hand, or defective sensibility on the other, the affection is the same throughout the whole course of the nerve, and generally through all the ramifications which proceed from the same trunk. Haller has stated this with his usual clearness and precision;⁹ and subsequent observations have confirmed the accuracy of his opinions.

But although, in a compound nerve, sensation and motion are commonly affected in the same way,—although they generally err together either by excess or defect—yet it is not always so. Motion may be impaired and the sensibility retained, or the converse of the proposition may be true. A case, which, some years since, I communicated to Sir Charles Bell, and which he has done me the honour to insert in the appendix to his work upon the nervous system, was an interesting example of both these conditions. Upon one side this patient had defective power of motion without any diminution of sensibility, but, on the contrary, a sense of heat; upon the other she had impaired sensibility, without any diminution of muscular power. With

⁹ Si plures ad musculos unus nervus distribuitur omnes ii muscoli convelluntur qui eo ab nervo ramos habent quem irritavimus.—*Elem. Phys.* iv. 322.

Irritato nervo multis musculis communi, totive artui, omnes ei muscoli convelluntur qui ab eo nervo nervos habent sub sede irritationis ortos.—*Ibid.* 325

the arm of this side she could readily hold her child; but it required the constant direction of the eye, as well as a distinct effort of the mind, to keep the arm from gradually loosening its hold and allowing the child to fall. Indeed, these two conditions of nerves in the same limb may even be in an inverted proportion to each other, as in an instance communicated by Sir Charles Bell to Dr. Cooke, who has given an outline of it in his work upon palsy. Pain, of a most agonizing kind, periodical, and alternating, had confined the patient for two years, and had quite subdued a powerful frame, while the muscles supplied with nervous energy from the same source were become paralytic and shrunk.¹ These facts are inexplicable, according to the ancient notion that the different offices of sensation and of muscular activity, to which a given nervous cord ministered, were the result merely of varied degrees of energy or action in the same filaments, but are intelligible upon the principle so amply established and aptly illustrated by modern physiologists, that what Mr. Abernethy called "a packet of nerves," though united in a single cord, is a compound of fibrils of different function, some contributing to sensation, others to muscular activity, but maintaining throughout their whole course a distinctness of texture, as of office, and each, probably, circumscribed and separated from the other by its own tunic.

This principle, of which it was left for the physiologists of our own time, especially Sir Charles Bell and Magendie, to prosecute the development, as well as to supply us with copious proofs and illustrations, did not altogether escape some medical writers of an early date. Even Galen was aware that a nerve, although to appearance a single cord, still consisted of many nerves contained in a single sheath;² that some of these were distributed to the muscles, and were for the purpose of motion, whilst others went onwards to the skin for the purpose of sensation;³ and that some of these nerves

¹ Cooke on Palsy, p. 98.

² Ab origine multi sunt concreti et communibus involucris contenti.—*Galen, de Locis Affectis*, lib. i. cap. 6.

³ Si itaque musculorum nervos affici contingat motus digitorum perit; si vero

might have their function impaired, to the exclusion of others : but he retained the doctrine prevalent in his time, that, after all, muscular motion required a stronger exertion of nervous energy, while a slighter would suffice for sensation ;⁴ an opinion which was entertained also by Haller.⁵ Willis, too, had more than a glimpse of the modern views with regard to the diverse functions of the several filaments of which a nervous cord consists, and applies them particularly to the recurrent, with respect to which he has this remarkable passage :—" The returning nerve, although it seems a branch sent forth from the trunk of the wandering pair, yet, for better conduct's sake, it is contained under the same coat with the rest of the wandering pair."⁶ And again: " it is very likely that of the fibres which are complicated together in the trunk of the wandering pair, one is distributed to the returning nerve, another to the præcordia, a third to the lungs, and, lastly, another to the ventricle ; all which, although they have communications among themselves, and, for the sake of a better conduct, are gathered together into one, yet they are distinct from their very original, and constitute divers passages for the animal spirits."⁷ Van Swieten also considered it as a point well known amongst physiologists, that some nerves minister to sensation, others to muscular motion ; and that, although they are perfectly distinct at their origin within the cranium, yet that, collected into one common trunk, they proceed together to their several destinations ; the nerves of motion, therefore, might, in his opinion, have their function impaired, whilst the nerves of sensation might either altogether escape, or be only slightly affected ; or the converse might be true.⁸

eos qui ad cutem perveniunt tangendi sensus corumpitur : sed ubi tota resolvuntur membra, cum videlicet commune principium affectum est simul et sensus et motus pereunt.—*Galen*, loc. cit.

⁴ Equidem id ipsum dicebam, quod priores medici dicere solebant, quod scilicet sensus in patiando, motus vero in faciendo aliquid, fit: quapropter, ut quis moveatur opus est robore; sed ut sentiat vel minima facultas sufficit.—*Ibid*.

⁵ Plus autem admotum quam ad sensum requiri multa ostendunt.—*Elem. Phys.* vol. iv. p. 299.

⁶ Description and Use of the Nerves, p. 147.

⁷ *Ibid*. p. 151.

⁸ Notum est physiologicis, nervos quosdam sensui, alios motui servire, qui distinctissimi licet sint in sua origine intra encephalum, tamen in truncos majores

It appears, then, and it is explained by this view of the intimate structure of a nerve, that the filaments of sensation may be affected, whilst those of muscular movement are unimpaired; or the latter may have their function disturbed, whilst the former are uninfluenced; or their morbid conditions may be incommensurate with each other; or the sentient and motor filaments may, even, be in opposite states in the same nerve. The late Mr. Shaw, in considering "why sensation should remain entire in a limb when all voluntary power over the action of its muscles is lost, or why muscular power should remain when feeling is gone," thinks "it is not too much to suppose that one origin of a nerve may be affected whilst the other remains entire;" and arrives at this practical conclusion, that "if only one set of functions of a spinal nerve be deficient, we should apply our remedies to that part of the system from which the nerve arises; but if both functions are impaired, we must then direct our inquiries to the state of the nerve in the whole course from its origin to its distribution, as the loss of power is probably owing to some affection of a part of the nerve after the two sets of filaments by which it arises are united together."⁹ The case to which I have before adverted, in which these two opposite conditions existed on different sides of the body, would seem to give countenance both to the principle and practice of my late lamented friend; but they are far from universally applicable. In the instance before alluded to, in Dr. Cooke's work, although the sentient filaments were in a state of excitement, the motor filaments paralysed, there was no suspicion of any affection of the *roots* of the nerves. The trunks were found tender, and acutely sensible to the slightest pressure, and the case was cured principally "*by repeated purging, and the application of leeches along the course of the nerves.*" In the case also related by Mr. Denmark,¹ to which I shall have occasion hereafter more particularly to advert, there were violent pains without, however, muscular spasms,

nervorum collecti ad partes corporis una deferentur. Potest ergo impediri functio nervorum moventium, dum nervi sentientes adhuc illibati sunt vel minus læsi; et vicissim.—*Comm. in Aph. Boerhav.* § 1057.

⁹ Med. Chir. Tr. vol. xii. p. 149.

¹ Med. Chir. Tr. vol. v.

although the symptoms arose from a wound followed by inflammation of the radial nerve in its course; and in many cases of ischias depending upon some inflammatory condition of the nerve, as in the examples related by Cotugno, Martinet, and others, the pain is often considerable, and shows itself in different parts of the limb; but the few muscles, which it supplies, altogether escape. These are glaring exceptions to the pathological principle and the "rule of practice," to which I have referred, and point decidedly to the conclusion that, even "after the two sets of filaments by which it arises are united together," one function of a nerve may be affected to the exclusion of the other, by an impression made upon its trunk; but there is nothing in all this which is calculated in the smallest degree to discountenance the statement, that the condition of a nerve will be identical throughout its whole course, whatsoever character the morbid affection may assume.

3.—*The morbid affections of nerves resolve themselves into those of excitement and those of defective energy.*

This general principle is so well established and so familiarly known, that it will, perhaps, be readily conceded without proof or illustration. The only modification of the statement, requiring even the slightest notice, is this, that in the nerves which supply the organs of the external senses, their function may not only be excessive or defective, but also vitiated or depraved. The eye may be unable to distinguish colours, though this may arise also from some imperfection in the perceptive faculty; the tongue may fail to recognise the true flavour of sapid particles; the ear may be assailed with particular sounds, without the corresponding external impressions; and the touch may be variously perverted. The causes of these disturbed states of function in nerves, which minister to the external senses, have hitherto been little investigated, and have eluded the discovery of pathologists. They have been recorded as insulated facts, without further arrangement than that founded upon the organ affected, and without any connecting link, in the form of a general law or principle, by which

they may be associated. But even if I possessed materials for the prosecution of this very interesting, [though difficult, inquiry into the pathological history of such perversions of the external senses, it would be unnecessary for me to enter upon a subject, which is not even remotely connected with the objects of the preceding investigation.

Each of these great divisions of the morbid affections of nerves will require a separate and detailed consideration; and the order, I shall pursue, will be to notice in succession the symptoms, the consequences, and the producing causes of each, beginning with those of excitement.

The treatment of these morbid conditions it is not my purpose to consider. My personal experience is too limited to enable me to do justice to a subject so comprehensive and so difficult, and which, after all, is not essential for the more restricted objects of my present inquiry.

Symptoms and consequences of excitement.

Excitement of a nerve, where it exists, will be recognised by the occurrence of pain, or muscular spasms, or the combination of the two, according as the nerve is one devoted to the purposes of sensation, or of motion, or of both. The branches derived from the ganglionic root of the fifth pair, which are distributed upon the surface of the face, are nerves exclusively of sensation, and morbid excitement in these branches occasions the agonising sufferings called neuralgic, and familiarly known as "*tic douloureux*" or "*the tic*." The portio dura of the seventh pair is a nerve exclusively of motion, and, when in a state of excitement, produces excessive and anormal movements of the muscles which it supplies. Excitement of a voluntary, compound, or symmetrical nerve, as in those gangliform enlargements which not unfrequently form on the extremities of the nerves in an amputated limb, will occasion at once severe neuralgic paroxysms referred to the former remote distribution of the nerve affected, and violent "convulsive jumping" of the limb.

The pain of a morbidly excited nerve, commonly called

neuralgic, is of a peculiar kind. It is sometimes periodical, much more frequently merely paroxysmal. It recurs at irregular periods, and from very slight causes, or occasionally from none that we can trace. It is also fearfully severe, and is commonly attended with local determination of blood to the part, with a distressing sense of heat, with an increase of secretion from the part, if situated upon or near a secerning surface, and with a proneness to inflame from slight causes.

Of its intermitting character, Mr. Swan has offered an explanation which is, perhaps, as near an approximation to the truth as any that has hitherto been adduced. "It may be," he says, "that a nerve cannot at first bear a diseased action without rest, any more than it can a healthy one; and, therefore, the diseased action, after a certain period, ceases to make any impression; but after this rest, the nerve acquires fresh powers, and is again fitted for action."² There is in this explanation some confusion, arising from a want of discrimination between the action and the producing cause. "The diseased action" is the painful paroxysm, *not* "the impression" which causes it. The author's meaning is probably this—that nerves, like other organs and faculties, in a diseased state are fatigued and exhausted by their vehement exertion; that they then cease to act, and after resting for a while again recover their power, when, in consequence of their morbid condition, their renewed exertion is irregular and violent. But this, to me, is not altogether satisfactory. It appears to be rather a statement of fact than an explanation; and amounts, after all, to little more than that the attacks of neuralgia are intermitting. The opinion of Bichat upon this point appears to have been somewhat similar; though this distinguished anatomist presents it rather as the assertion of a fact than as an explanation; or applies it as a general law or attribute of the nervous system in a state of health rather than disease.³ Were it not for this peculiar

² On Diseases and Injuries of Nerves, p. 13.

³ Dans les expériences, la sensibilité animale du nerf semble s'épuiser peu à peu, et cesser enfin.—Si on cesse d'exciter le nerf pendant une heure ou

attribute of neuralgia, life would more frequently fall a sacrifice to the disease; as it is, these pains may "quite subdue a powerful frame,"⁴ and, in some instances, "may wear out the patient's health, and destroy him at last."⁵

It might be expected that, where disease exists in those parts of the animal body upon which sensibility and sensation depend, the pain would be inordinately severe; and no stronger proofs that such is the case are required, than the physical and articulate expressions of agony which the most patient sufferers from this malady present to us. Nothing can exceed the distress depicted upon the countenance during a paroxysm, and the language is by no means extravagant, or hyperbolical, when patients designate their sufferings as acute and severe beyond endurance—as *excruciating, agonizing, fearful, horrible*; expressions, all of which I have again and again heard from individuals labouring under the *tic douloureux*. These pains are influenced by very slight causes. I have known them in facial neuralgia aggravated or reproduced by slight mental irritation, by a current of cold air, by mastication, by speaking or by touching the part accidentally with the sleeve of a coat, a handkerchief, or a towel. Pressure with the finger, in neuralgia of the scalp, to ascertain the condition of the part has produced pain so insupportable as to appear like piercing the scull from the point of pressure to the angle of the orbit, with general convulsions like epilepsy, sometimes even accompanied with foaming at the mouth; similar convulsions being produced by combing the hair, or by the razor in shaving the part affected; even atmospheric changes have influenced the paroxysms.⁶ They are also affected by indiscretions of diet, by irritating local applications, by too violent exercise, by season, and by climate.⁷ Even drawing on a glove has made the patient scream and fall to the ground.⁸

deux, la sensibilité se renouvelle avec beaucoup d'énergie, lorsqu'on vient à le tirailler de nouveau.—Anatomie Générale, tom. i. p. 163.

⁴ Bell, in Cooke on Palsy, p. 98.

⁵ Bell's Operative Surgery, vol. ii. p. 330.

⁶ Pouteau Œuvres posthumes, vol. ii.

⁷ Ollivier, Dict. de Med. in verbo Névralgie.

⁸ Earle, Med. Chir. vol. vii. p. 180.

Neuralgic affections are, also, frequently attended with local determinations of blood to the part, with, probably, increase of arterial action. That nerves do in reality influence the capillary circulation, as the minute extremities of the arterial tubes are often denominated, is a point which has been elaborately, but somewhat diffusely, argued by Mr. Swan, who decides in the affirmative; and there is, in fact, no dearth of evidence of the effect of nervous influence, even in the most healthy condition of the nervous system, in increasing the activity of the arterial circulation. A hint, or an indecent allusion, which affects the sensitive mind of a delicate female, calls a blush upon the cheek, and is followed by a sense of heat. She is conscious of the change, and literally *feels* that she blushes. The consciousness of this adds to her embarrassment; the action of the vessels of the face and neck is still further increased,—“she blushes up to the eyes,” and her whole neck is suffused with redness; her cheek and neck also burn with heat; and, at length upon some occasions the vessels unload themselves by pouring out a partial, though often a copious, perspiration. In these cases the moral impression must be upon the nerves; and what is here observed in a state of health, is also manifest in a diseased condition. The existence of such local determination of blood to parts, which are the subjects of painful affections of the nerves, has been established by the concurrent testimony of most writers upon these diseases; but by none has it been so explicitly stated as by Mr. Earle, in his valuable and instructive paper, “On the Influence of the Nervous System in regulating Animal Heat.” He exemplifies it in an instance of painful condition of the nerves of the forehead and face, in which “there was a well-defined red line in the whole course of the supra-orbital nerve, accompanied with so much heat as readily to evaporate any cold water which was applied.” And he further thus sums up the result of his extensive experience:—“In no case, perhaps, is the effect of a local determination of blood more marked than in tic douloureux. In every instance of this distressing malady which has fallen under my observation, during each paroxysm of pain there was an evident

increased flow of blood to the part, accompanied with an increase of heat, more or less perceptible.”⁹ M. Pouteau also observed the same condition in three instances of neuralgic affection of the scalp from violent contusions. In each the neuralgia had continued long after the accident. In one case the patient spoke of the blow as long since (*anciennement*) received; in a second twelve months, and in the other sixteen years had elapsed from the infliction of the injury. The dull red colour of the first, the red surface an inch in diameter of the second, and the slight swelling with redness of the skin in the third, must have arisen in these examples of very severe neuralgia from the diseased condition of the nerves which continued after the other textures had recovered from the contusion, and could not have been simply from the injury of the scalp, or even of the pericranium, as Pouteau believed.¹

The result of this local determination of blood to a part is a corresponding increase of temperature. This is also mentioned as having occurred in one of his cases by M. Pouteau, who denominated it “une chaleur brulante,” and is incidentally noticed by Mr. Swan, but minutely considered by Mr. Earle, who ascribes it to some direct influence of the nervous system unconnected with the arterial circulation. He states this explicitly with respect to the coldness from defective nervous energy, in which “the circulation of the blood has been apparently *unaltered* either in degree or quantity;” and thus countenances, by the argument *e converso*, the opinion that increased nervous energy causes an increase of temperature, also, by some direct influence upon the evolution of animal heat, unconnected with the arterial circulation; or, if the two have any relation to each other, this eminent surgeon is disposed to think that “the principle of vital heat is the result of the action of the arterious blood on the nerves,” rather than of the action of the nerves upon the capillary circulation. With the utmost deference, however, to one who deserves so well of his profession, I may be permitted to doubt the accuracy of this opinion; and this, without casting the slightest degree

⁹ Med. Chir. Trans. vii. p. 187.

¹ Œuvres posthumes, vol. ii. p. 77.

of discredit upon the interesting experiments of Sir B. Brodie and Dr. Davy, whose accuracy and fidelity are unquestionable. Most chemists agree that the capacity for heat of arterial blood is greater than that of venous blood; and the inference is obvious, that in the transition from arterial blood to its venous state, which takes place in the capillary circulation, the capacity for caloric is diminished, and latent heat therefore evolved.

In the discussions which have taken place upon the intricate subject of the evolution of animal heat, some important points seem to have been too little considered. It has been apparently assumed that the only change of the blood which influences the extrication of free caloric, is that, of which the alteration of colour is the sign, namely carbonization. In the capillary circulation, however, other very important changes ordinarily accompany this transition from one colour to another, besides the alteration of the relative proportion of carbon. Secretion, for instance, is one of those changes, and the deposit, also, into the interstitial tissues of the different parts and organs of the body, (down even to the coats of the most minute arterial ramification by its own *vasa vasorum*) of the materials of nourishment and growth, to supply the deficiency occasioned by that gradual decay or removal of parts which is hourly going on; and, how much of the extrication of heat is to be ascribed to these chemico-vital changes in the constituent elements of blood, how much to the addition of the carbonaceous principle, has never been clearly ascertained. The experiments of Sir B. Brodie, confirmed by the observations of Mr. Earle, lead me strongly to suspect that, at least, as much is to be ascribed to these co-incident and collateral functions of the capillary vessels, as to the mere accumulation of carbon; and hence in cases where, nervous energy being annihilated, arterial action is kept up for a while by artificial respiration, the functions of secretion and assimilation being impaired, the supply of free caloric is imperfect also.

In the experiments, therefore, of Sir B. Brodie, no disengagement of heat took place during artificial respiration, because

the functions of secretion and, more especially, of assimilation were deranged or suspended in consequence of the annihilation of that nervous energy which is required for these operations of the economy. It is in evidence, then, that in cases of morbid excitement of nerves, there is "a local increased action of the blood-vessels,"² "an increased flow of blood to the part,"³ proved by the well-defined red line in the whole course of the nerves affected; there is, "*fièvre au moins locale*."⁴ It is, at all events, commonly believed, that it is in consequence of the change of capacity for caloric which takes place at the moment of the transition from venous to arterial blood in the capillary circulation, that animal heat is extricated; and it is quite intelligible, therefore, how an increase of the arterial circulation should evolve an additional quantity of animal heat. But it is neither proved, nor *attempted* to be explained how an increase of nervous influence, unconnected with the circulation, should produce that effect.

Another consequence of the increased flow of blood to the part is some degree of swelling, with, frequently, increase of secretion. The swelling in these cases is generally inconsiderable. It is rather a diffuse fulness than a positive intumescence, appears to be rather the result of vascular congestion than effusion, and is confined generally to the integuments. This was particularly noticed by Mr. Earle in the case of Maria May, in whom in the arm affected "the integuments were hotter and *fuller* than natural."⁵ Mr. Guthrie, also, observed it in the case of an officer wounded in the arm, in whom "the parts affected were rather *swelled*," and who during a twelve-month suffered an aggravation of the pain, uneasiness, and *swelling* of the hand, which his physician in the country conceived to be an attack of rheumatism.⁶ When the ophthalmic branch of the fifth pair is the seat of neuralgia, during the paroxysm tears will flow in abundance from the eye upon that side, the lachrymal gland deriving its nervous energy

² Swan, p. 12.

³ Earle, already quoted.

⁴ Descot sur les affections locales des nerfs, p. 198.

⁵ Med. Chir. Tr. vol. vii. p. 180.

⁶ On gun-shot wounds, &c. 2nd edit. p. 161.

from that source. Mr. Swan has advanced, in proof of the existence of a local increased action of the blood-vessels, "the appearance of the parts to which the affected nerve is distributed, and frequently the increased secretion of saliva when the nerves distributed to these glands are implicated;"⁷ and in the case of "severe nervous affection after a punctured wound of the finger," related by Mr. Wardrop,⁸ the skin of the finger became "so acutely sensible, that she could not bear it to be touched; even the dread of any thing coming in contact with it would make not only the finger but *the whole hand flow with perspiration.*"

In some rare instances there has appeared, in consequence of the increased activity of the minute vessels of supply, an approach to hypertrophy in some of the parts upon which the nerves affected are distributed. The diffuse swelling, already noticed, may possibly be in some measure connected with this, as well as the change of the hair mentioned by Pouteau in one of the cases which he has minutely detailed in his posthumous memoir, "On the danger of injuries of the head even where the hairy scalp alone is implicated." This was in a young man of twenty-four years of age who had been subject, since a fall upon his head from a height of twenty feet some sixteen years before, to such violent neuralgia, that during the attacks he would fall down in his chamber completely insensible, the countenance become inflamed with heat, but especially upon the side affected, where it was positively scorching. He had very beautiful hair, for which, however, he paid dearly, for whenever the comb passed over the injured part of the scalp the pains became inordinately severe; the hair at that part was thicker and harder than elsewhere, and never lay flat like the rest; and, whenever any occasional cause aggravated the pains, it made, also, "each individual hair to stand on end,"—after a most inconvenient fashion.⁹ The

⁷ Swan, p. 11.

⁸ Med. Chir. Tr. v. viii. p. 247.

⁹ "M . . . portoit de fort beaux cheveux mais il payoit bien cher cet agrément; car toutes les fois que le peigne passoit sur la partie lésée du cuir chevelu, les douleurs devenoient atroces; les cheveux en cet endroit étoient plus gros et plus durs que par-tout ailleurs; ils n'étoient jamais couchés comme

swelling, with redness, in this and the other cases related by Pouteau, he ascribed to some effusion the consequence of the original contusion under the scalp or, perhaps, under the pericranium, which, becoming acrid from retention, would irritate most painfully the nervous fibrils with which they might come in contact. It was, principally, with a view to relieve this swelling, and to let out this fluid, that in these cases he had recourse to extensive incisions, but not exclusively; for, in one passage, he distinctly announces his purpose to have been to destroy the nerves themselves.¹

Mr. Swan thinks the same thing may happen to the nerves themselves, which "may become enlarged from irritation in the same way as the muscles from continued action, without losing their healthy character."² He adduces, however, no instances in illustration of this impression upon his mind—for it amounts to no more—and I have been unable to verify this speculative opinion either by my own observations, or by those of any author with whose writings I am familiar. They "may become enlarged," therefore, from this cause, but the point is not ascertained.

One other remote consequence of this arterial excitement remains to be noticed. This is, a proneness to inflammation from slight causes, and a corresponding difficulty of cure. Two instructive examples of this have lately presented themselves to my notice.

CASE.—A lady, the mother of several children, had after one of her labours, severe suffering in her back extending to the abdomen, which was exquisitely tender to the touch. Violent pain afterwards occurred along the course of the great sciatic nerve, so as in sitting to prevent her from resting upon that side of the nates. It was obvious that the very respectable practitioners, under whose care she then was and continued for a lengthened period, considered it as an affection

les autres, et ils se hérissoient de la façon la plus incommode lorsque quelque cause occasionnelle donnoit une nouvelle activité aux douleurs."—*Op. Citato*, p. 93.

¹ "J'imaginai alors de détruire tous les nerfs qui alloient porter le sentiment dans cette portion de peau, et du péricrâne malade."—p. 98.

² Diseases of the Nerves, p. 11.

of the origin of the sciatic in the lumbar and sacral nerves ; for their principal treatment consisted in the application of leeches and repeated blisters, alternately, to each side of the lower part of the vertebral column. In a subsequent pregnancy, for three months previously to her delivery she was unable to leave her house, and scarcely even her chamber, on account of violent suffering a little to one side of the lower lumbar vertebræ and of the sacrum, extending to the abdominal parietes of that side, to which it was so strictly limited that its extent was defined accurately by the lineæ alba. This greatly increased after her delivery, was of that hyper-acute kind which denoted its neuralgic character, and was liable to fearful aggravations from the slightest movement or pressure. Upon the opposite side of the abdomen the deepest pressure produced no suffering ; and it was evident that there was no tension in any one part of the abdominal cavity. As a matter of precaution, lest there might be any lurking subjacent inflammation I suggested the application of leeches to the abdominal parietes, although my patient assured me that on the former occasion they had been tried without success. She yielded, however, to my recommendation ; but they were followed by an aggravation, rather than any subsidence of the symptoms. They produced erysipelatous inflammation, followed by little ulcerations around the orifices from the leech-bites, which were exquisitely sore and sensitive, and weeks elapsed before they assumed a healthy character, or showed any disposition to heal. The great sciatic nerve, which had not altogether escaped during pregnancy, now became more violently affected ; pains shot in the direction of its more superficial sensitive branches in different parts of the limb ; and one of her most prominent symptoms was a very severe pain, accompanied with throbbing, under the ankle. When I pressed upon the nerve, as it here passes upon the side of the os calcis, she suddenly drew away her leg, on account of a lancinating pain which darted under the sole of the foot.³

³ This is the second instance which has fallen within my observation of neuralgic suffering referred to the heel from irritation, perhaps some accidental

CASE.—Whilst in attendance upon this lady, I was consulted by a patient in Chelsea, who, being about five months advanced in gestation, had small oblong, hardish, and circumscribed tumors under the integuments of the leg, close to the inner edge of the tibia. These were exquisitely tender, and were allied to, if not identical with, the disease described by Mr. Wood⁴ under the denomination of painful subcutaneous tubercle, as well as some very interesting cases detailed with great minuteness by the late Mr. John Pearson.⁵

All exertion and the slightest pressure, as from a stocking or the bed-clothes, produced intense suffering in the part, darting towards the foot. A very respectable practitioner had applied leeches to the part, but without the slightest relief. They produced surrounding inflammation, and the leech-bites festering, they remained unhealed, ulcerated, and exquisitely sore for many weeks. The symptoms at length yielded partially to confinement to the bed, (the leg being protected by what was equivalent to a fracture-cradle,) to the sedulous application of cold evaporating lotions with opium, gentle aperients, and an abstemious regimen. She, however, continued for some time subject to a recurrence of her symptoms, and was obliged, therefore, to be very cautious as to exertion. A long walk or too long continuance in the erect posture produced such uneasy feelings, as powerfully to warn her of the necessity for recurring to the horizontal position.

If any excuse be requisite for the introduction of these cases, I can but plead their interesting nature, their connexion with the symptoms of morbid excitement of individual nerves,

inflammation about the roots of the sciatic nerve. In the other case, the lady was subject, at distant intervals, to attacks of such agonizing pain as to confine her to her chamber—often to her bed; and for some time after such attack she could do no more than hobble about her house on crutches. I have seen little of this lady for some years, but have reason to believe, that since two great causes of additional excitement have been removed by time—menstruation and child-bearing—she has been entirely free from her former attacks. She bore with stoic fortitude the sufferings, which she more than once described to me as like those which she supposed the violent driving of a large iron screw into the heel would produce.

⁴ Edin. Med. and Phys. Journ. vol. viii.

⁵ Med. Facts and Obs. vol. vi.

and the conclusion to which they lead. They seem to inculcate this practical precept—that where painful symptoms arise from some cause of irritation, as inflammation or tumour at the origin or in the course of a nerve, the symptoms, however, manifesting themselves at some distance from the seat of the disease, then, as in Sir Charles Bell's case, communicated to the public by Dr. Cooke, “by repeated leeches along the course of the nerve, together with some other remedies, the patient may be restored to health;” but leeches applied to the part in which the symptoms appear, seem frequently to add a new and painful disease, without corresponding relief to the original malady. They do more harm by the irritation they excite, than they do good by the abstraction of blood.

What is the precise condition of a nerve in a state of excitement, characterised by pain, or convulsive movement, or the combination of the two in the part which it supplies, is a question which, in the present state of our knowledge, or rather ignorance, of the nature of nervous influence, it is far from easy to determine. Until we have ascertained what is the precise condition of a nerve in the exercise of its natural function, it is impossible to understand in what a morbid excess of that state consists; and of both we are profoundly ignorant. We recognise them only in their effects.

It is scarcely necessary for me, upon this point, to advert to the different theories which have been advanced to explain the functions of nerves. The doctrine of the circulation of a fluid in tubes, there being no sufficient proof of the existence either of a fluid or of tubes, as well as that which refers the phenomena of nervous influence to certain vibrations, have had each its advocates; but they have now given place to the more recent doctrine, that the exercise of nervous energy depends upon galvanic influence, and, indeed, that these are the same in essence. The evidence, however, upon which it has been alleged that this important vital function is dependent merely upon galvanic agency, is, in my estimation, far from conclusive. Galvanism may, indeed, excite the action of a nerve, and, by re-establishing a communication between the extremities of a divided nerve, may produce a renewal of

its powers ; but, with the utmost deference to the opinions of those who by their talent and exertions have won for themselves golden opinions, their experiments and observations appear to me to be totally insufficient to establish the identity in essence of nervous energy and galvanism. A metallic tube may be divided and re-united by a leathern hose ; the office of the tube is restored, but the communicating medium is not a metallic tube : so, divided nerves are brought in contact or communication by metallic bodies passing from one cut extremity to another, or from one nerve to another, and nervous influence is supposed to be generated—I should rather say excited or produced. But this is no sufficient proof that the metallic communication is equivalent to nerve in all its offices and attributes, or that galvanism is nervous energy. I believe galvanism to be to the nerve in these cases what venous blood is to the right, and arterial to the left side, of the heart ; or, to come nearer to my own subject, what arterial blood is to the brain. It excites, for a while, action in the separate nervous filaments ; but it is neither nerve nor the function of nerve—it is neither nervous energy, nor the exertion of that energy.

Mr. Swan has, in his work upon the Diseases of Nerves, reproduced the doctrine of vibration, though somewhat modified. He does not, indeed, assert that in the production of the phenomena of nervous energy the nerves vibrate like a musical chord, but he inclines to the opinion that there is “ *action, so as to produce motion for the ordinary functions of the nerves ;*” that “ from the great retraction after their division, and the sometimes straight and sometimes waved or tortuous appearance of the fibrils, it is most probable that their state is not altogether passive.”⁶ The transition from this opinion with regard to the ordinary function of nerves, supposing it to be established, to that which would refer an excited state of the nerve to an inordinate degree of the same “ motion,” is natural, easy, and obvious ; and, accordingly, Mr. Swan arrives at that conclusion, as appears from the following passages in his works :—“ I conceive,” says this

⁶ On Diseases of the Nerves, p. 4.

generally judicious and practical writer, "that in some cases there is a contraction of the nerve itself, which produces pain;" and again, "I conceive that contractions of the nerves may take place and produce pain in the same manner as those of the muscles during their violent action in cramp or tetanus."⁷ "When pain has been excited in any distinct and previously healthy part by a disordered organ, and has arisen in the first instance merely from a contraction or *spasm of the nerve*, it may have been so often repeated as to have produced sufficient action of the nerves and blood-vessels for making the surrounding parts irritable and liable to be affected with a variety of fresh causes, even when *the organ that first produced the pain* has resumed its healthy functions."⁸ Lastly; "Tic douloureux in the nerves of the head and face may arise from a *spasm of the nerve* through sympathy with a distant part."⁹

I must acknowledge that these statements convey to my mind no such definite notion, as to enable me to comprehend what is the precise pathological condition, to which Mr. Swan alludes, of an excited nerve. If it be really meant that the state of the nerve, under such circumstances, is identical with that anormal condition of muscular fibre which is the essence of convulsive movement, there is at least a deficiency, perhaps I may venture to add a total absence, of proof that it is so. It is, indeed, within the bounds of possibility that such may be the case; but the fact has not been ascertained, and, if we are to take the expression literally, rather than as figurative or illustrative, it is, in the present state of our knowledge, at best but a speculative notion, involving the incautious application of a term hitherto appropriated exclusively to an anormal condition of muscular textures, and is calculated to lead to confusion and error, rather than to the elucidation of that obscurity in which this intricate subject is already involved.

⁷ On Diseases of Nerves, pp. 4, 5.

⁸ Ibid. p. 17.

⁹ Ibid. p. 39.

Causes of Excitement.

Such being the symptoms and consequences of excitement of a nerve, I shall next proceed to consider the causes which may produce that pathological condition. Amongst these may be enumerated sudden mechanical impulse or other local stimuli, vascular congestion or irritation, inflammation, structural disease, and sometimes mere functional disorder: and from this enumeration it must be obvious that they must be numerous, inasmuch as there may be many causes and modifications of mechanical impulse, perhaps of congestion, certainly of inflammation and its consequences, and equally certainly of functional disorder.

That sudden and violent *mechanical impressions* upon the trunks of nerves, in any part of their course, may produce symptoms of excitement in the parts which they supply, has been known from a remote period, and is proved by the results of the endless experiments of physiologists, who have pricked them with a needle or the point of a scalpel, or pinched them with dissecting forceps, as the instruments most ready to their hands.

These experiments have been most commonly made upon nerves of motion, the effects of which are obvious to the senses, as convulsive movements are the result. Upon this point the observation of Haller, and the simple and interesting experiment of Sir Charles Bell, confirmed by those of Magendie, upon the anterior roots of the spinal nerves, are conclusive. "Deinde irritato nervo convulsio in musculo oritur qui ab eo ramos habet."¹—"On irritating the anterior roots of the nerve, at each touch of the forceps there was a corresponding motion of the muscles to which the nerve was distributed. Every touch of the probe or needle on the threads of this root was attended with a muscular motion as distinct as the motion produced by touching the keys of a harpsichord."² Again, "on irritating the nerve of the fifth pair at its root," the

¹ Elem. Phys. vol. iv. p. 325.

² Bell on the Nervous System, p. 31.

muscles of the jaw acted, and the jaw 'closed with a snap;' ³ and Mr. Shaw adds, "so as to nip an assistant's finger severely."⁴—"When the anterior roots singly, or the whole spinal nerve, was pinched by the forceps, or pricked by the scissors, an evident motion was produced on the muscles, not only perceptible to the eye, but when the third or fourth dorsal nerve was touched, the whole scapula moved in the hands of the assistant. . . . The motion given to the muscles was not the slight tremulous motion arising from the natural irritability still remaining in them, but it was *convulsive and spasmodic*, and followed each successive prick of the scissors."⁵ "The slightest touch on the *portio dura* or respiratory nerve convulsed the muscles of the face, whilst the animal gave no sign of pain."⁶ Such are the evidences of the influence of sudden mechanical impressions upon motor nerves: they not only produce action, but action which, in the language of Mr. Cæsar Hawkins, is "convulsive and spasmodic."—"Convulsio oritur."

It is the same with nerves of sensation: the sensibility is augmented, and pain the consequence. If an ass be tied and thrown, and the "superior maxillary branch of the fifth nerve exposed, touching this nerve gives acute pain."⁷ And again: "the cutting of the fifth nerve gave pain in a degree corresponding with our notions of the sensibility of nerves."⁸ With regard to the spinal nerves, strictly so called, the experiments of Magendie are the most decisive we possess: when he "pinched, stretched, or cut the posterior roots, or the nerves of sensibility, the animal exhibited signs of pain, but not to be compared, in intensity, with that produced by even a slight touch of the spinal marrow at their origin."⁹

From experiments upon nerves which minister both to sensibility and motion, these mechanical stimuli produce both convulsive movement and pain; for "when a nerve is pinched or pricked, the muscles, which it supplies, contract with more

³ Bell on the Nervous System, p. 35.

⁴ Ibid. p. 63.

⁵ Note of Experiments performed by Mr. Shaw, by Mr. Cæsar Hawkins.

⁶ Bell, p. 80.

⁷ Ibid. p. 74.

⁸ Ibid. p. 79.

⁹ Journ. de Physiol. vol. ii. p. 368.

or less violence, and at the same time the animal experiences suffering more or less severe.”¹

Pathological facts lead to the same conclusions. In the case of a late estimable physician, a spiculum of bone within the cranium, irritating (if we may judge from the effect) a nerve of sensation at its very origin, produced incurable *tic douloureux*, and, ultimately, serous infusion, which was probably the cause of death. In many instances, a similar cause operating upon the cerebrum has produced epileptic convulsions; and it is said that a sharp fragment at the end of a bone of a stump has, by coming occasionally in contact with the extremity of a nerve, occasioned the combination of violent neuralgia and muscular spasms—violent, uncontrollable, and painful jumpings of the stump. Another form of mechanical impulse which, it is generally believed, will produce a morbid development of nervous energy, is *forcible distention*. This stretching of the medullary filaments constitutes the foundation and essence of the distinction, adopted by M. Portal, of the diseases of nerves into those of painful and convulsive stretching, and those which are characterised by the insensibility of compression; and he adduces, as illustrations, the opposite conditions of the nerves of the thighs, according as these are distended upon the one hand, or compressed upon the other, by the gravid uterus.² It forms also a most important element in the explanation offered by Mr. Swan, “of the painful consequences of partial division;”³ and as its effects constitute the introduction of his chapter on “the compression of nerves,” it may be, perhaps, inferred, that he considers distention and compression as similar or identical in their influence. “A nerve,” he says, “may be *extended* some way without giving pain or uneasiness; as I have frequently observed in making experiments, when I have passed a probe under the sciatic nerve and drawn this from its situation, and as is shown in cases of popliteal aneurism, when

¹ Rapport sur des Expériences relatives aux Fonctions du Système Nerveux, par Cuvier.—Journ. de Phys. vol. ii. p. 372.

² Anatomie Médicale, vol. iv. p. 143.—Also, p. 275.

³ On Diseases of the Nerves, p. 111.

the swelling may attain some size before much pain is produced. But when a nerve is extended in any considerable degree, pain is excited ; and if the extension be increased, the pain is increased in proportion, till at length the nerve begins to ulcerate ; and if the pressure be not removed, it becomes almost destroyed by this process.”⁴ From this statement of fact, upon unquestionable authority, I should be induced to draw the conclusion that distention alone is *not* sufficient to produce excitement of a nerve. The effects of excitement are generally in proportion to the suddenness with which the cause is applied ; but here no pain attended the first degree and early periods of extension. It would seem, that it was not until the approach of ulceration that suffering was induced. Ulceration, however, is commonly preceded by inflammation, and this is amongst the most common causes of neuralgic attacks. It is, therefore, probably rather to the inflammation, which precedes the ulceration and is the consequence of this mode of mechanical violence, that the suffering should be ascribed, than to the nerve being simply extended. If there be no inflammation, observation and experiment combine to prove that paralysis is infinitely more common, as the consequence of stretching.

This view of the subject is much confirmed by the observations of Bichat and Bourdon upon the same subject. The former contents himself with alleging, in general terms, that sudden distention more completely *interrupts* (“interrompt,”) sensation and movement than that which is produced slowly ;⁵ the latter alludes to the occurrence of *paralytic* asphyxia, from the “*tiraillement*” of the recurrent nerve produced by aneurism of the arch of the aorta, at that part around which this important nerve winds, before it proceeds to its destination.⁶

The experiments of M. Descot upon this point appear to me to be inconclusive ; or, if they justify any particular inference, it is that distention of the nerve itself is little painful, unless

⁴ On Diseases of Nerves. Chapter ix. “Of the compression of nerves.” p. 155.

⁵ Anat. Gen. tom. i. p. 160.

⁶ Principes de Physiologie Médicale, partie deuxième, p. 678.

carried to the extent of tearing it asunder, or, at all events, unless some of its filaments are separated by the violence. He distinctly states that "they may be gradually elongated without any change of their texture, or considerable disturbance of their functions, as in cases of exophthalmia when it occurs gradually."⁷ But he alleges that the functions of the nerve suffer materially when the distention is more sudden, as is the case when the nerves are raised by a popliteal aneurism, as well as in some instances of acute exophthalmia. Cases, however, of neuralgia accompanying popliteal aneurism admit of another and more satisfactory explanation, as will appear hereafter from a consideration of some recorded examples of this kind:—and as to the pain from "*exophthalmie aiguë*," it is probable that in such instances the eye has been displaced by inflammation behind the globe, of which the nerves, in all probability, have also partaken. With regard to the experiments which M. Descot instituted with a view to the elucidation of this point, they were accompanied with so much violence to surrounding textures in addition to the tearing asunder of the whole nerve, that it is difficult to ascertain how much "*d'une violente douleur*" was to be ascribed to the injury of the nerve, and how much to the other mischief inflicted. The latter could not have been inconsiderable, seeing that the nerve, elevated by a blunt instrument, did not give way at the part where the injury was inflicted, but at a distance of five or six inches from that part, and below it. A case of extensive laceration of the arm by a spinning machine, also, communicated by M. Beclard, would lead one to suppose that the pain was rather to be referred to the surrounding injury than to the nerve itself, as, notwithstanding that a large nerve was completely torn asunder, no immediate and severe ill consequences followed, and afterwards nothing but the loss of skin interrupted the progress of cicatrisation.⁸ My friend, Mr. Phillips, of Wimpole-street, too, who is much conversant with experiments of this kind, and with the progress of experimental physiology amongst our continental neighbours, has assured me that in the course of his own experiments upon

⁷ Des Affect. Loc. des Nerfs, p. 46.

⁸ Descot, p. 48.

nerves, he has raised them from their natural position to the extent of from half to three quarters of an inch with the handle of a dissecting-knife, and although they were nerves which ministered both to sensation and motion, neither suffering nor convulsive movement resulted from the injury inflicted. When the nerve was distended rapidly, a paralytic affection appeared to be the only consequence. This, however, gradually subsided, the nerve apparently becoming accustomed to the elongation of its filaments, and resuming its function, notwithstanding the continued operation of the distending cause.

Another mode of mechanical impulse is that occasioned by *a blow upon the trunk of a nerve* from any blunt instrument, as in the trick common amongst schoolboys of striking "the funny bone" with a key. The ring and the little finger immediately start from their position with a convulsive movement, which is moreover attended with a severe and tingling pain. The consequences of this mode of mechanical violence vary according to the degree of injury inflicted upon the nerve. Sometimes, as in the schoolboy's experiment upon the ulnar nerve, the blow being slight, the nerve suffers no disorganization, and the effect, like that of an electric shock, is evanescent. The nerve, in such cases, speedily recovers its function with that peculiar sensation, familiarly known as "pins and needles." In other instances the nerve is bruised by the injury but retains its continuity. Inflammation is, then, apt to supervene, and to excite a train of characteristic symptoms, which I am to notice hereafter. Lastly, upon some occasions the nerve is completely crushed by the violence, when its function is permanently destroyed, as in an interesting example communicated to Descot by Beclard, in which, from a blow across the orbit with the end of an umbrella, which tore up the floor of that bony cavity, the supra-orbital and the infra-orbital branches of the fifth were implicated (especially the latter,) as well as, probably, some of those ramifications of the portio dura which "go forward to the orbicular muscles of the eye-lids, and communicate with the supra-orbital nerve;"¹

¹ Swan's Description of the Nerves, 4to. p. 47.

for from the period of the injury the upper lip was permanently insensible, the eye half amaurotic, and the upper eyelid partially paralysed.

Other stimuli, if violent in character or sudden in application, may also excite a nerve to excessive and anormal exertion of its influence. So electricity and galvanism directed suddenly, and in their concentrated form (as from an electric or powerful galvanic battery) upon the trunk of a given nerve, will excite to involuntary movement the muscles which it supplies, even for some time after the death of the animal; and these agents are amongst the most familiar remedies for defective energy. Concentrated acids have, also, in the experiments of physiologists, been frequently applied to nerves exposed by dissection, and convulsive movement has been the result. “*Dum nervum quemcunque irritavimus sed chemico veneno minus, scalpello melius, continuo is musculus, quem nervus adit, contrahitur, et motu, ad quem factus est, defungitur, artumque suum aut flectit, aut extendit, aut alio quocunque modo emovet.*”² Even cold may be enumerated amongst such chemical stimuli acting by direct application; for Haller expressly asserts, that touching a nerve with a cold sponge will occasion a convulsion.³

A nerve may be also morbidly excited, so as to produce what Bichat and others have denominated “an exaltation of function,” by *vascular congestion and irritation* of the nerve itself, perhaps even of contiguous parts from which the nerve derives its arteries, upon the due action of which the ordinary performance of its function depends. This is proved by the negative evidence of exposure to severe cold, which benumbs the faculties, and deprives the sentient extremities of the fingers of their sensibility. It is also strikingly exemplified in the effect, upon some constitutions, of cold bathing, which, driving the blood from the surface to the interior, leaves the nails blue, like those of a corpse, and the fingers at once bloodless, powerless, and all but insensible. The converse is, perhaps, equally true. If blood, as in blushing or violent

² Haller, Elem. Phys. vol. iv. p. 322.

³ “*A nervo spongia frigida tacto convulsio.*”

anger, be sent in superabundant quantity to a particular part, that part is red, and violently hot, and augmented secretion frequently results: the ordinary attributes of the nerve are increased: this, however, is rarely more than morally painful—there is no positive physical suffering; but if there be inflammation, the extremities of the nerves may partake of the inflammatory action, and pain will, then, be the consequence.

It has been frequently observed, and I believe with truth, that irritation of the trunk of a nerve will be followed by the same consequences as excitement of its extremity. Of this, no better illustration can be offered than the experiments of physiologists upon the pneumo-gastric nerves. It is well known that any cause of irritation applied to the extremities of these nerves in the larynx, trachea, bronchi, or pulmonary cells, which all derive their nervous energy from the same common trunk, will occasion violent cough; and Cruveilhier found that mechanical irritation of the same nerve in its course was productive of a similar effect—the occurrence of violent spasmodic cough.

Now, since local determinations of blood to the surface are found to produce an excessive development of nervous energy, as is proved by its influence upon the capillaries in increasing heat, it is probable that congestion of the vessels of the neurilema of the trunk of a given nerve, especially if accompanied with arterial excitement, may occasion similar results at the ultimate distribution of that nerve. After all, however, it may be difficult to define with accuracy the line of demarcation between mere congestion with increased arterial activity upon the one hand, and actual inflammation upon the other,—so closely do they approximate to each other; and what we ascribe to mere congestion and increased arterial action may, in truth, be the result of inflammation in some part of the course of the nerve.

Analogy appears to have led to the belief that in nerves, as in the brain, vascular turgescence and irritation, short, however, of the occurrence of inflammation, though having a strong tendency to terminate in that pathological condition,

may produce a morbid excess of nervous energy. Excessive arterial action within the cranium is said to produce such an irritable state of the nerves which minister to the organs of sense, as to render them acutely and painfully sensitive to their ordinary stimuli; this being the only evidence of their excited state, for it does not appear that they are subject to neuralgia: hence the intolerance of light and sound so characteristic of cerebral excitement. But since in the most favourable of these cases, where the patient is cured by active remedies, the question of the existence or non-existence of actual inflammation, in a greater or less degree, cannot be definitively determined; since we generally find that mere arterial fulness, even to the extent of threatening or producing extravasation of blood, more frequently occasions torpor or local palsies than irritation; and lastly, since these symptoms of excitement of the organs of sense are so frequently the mere precursors of the more prominent and formidable phenomena characteristic of phrenitis, it is far from impossible that even in such cases, and at such early period of the malady, there may be some degree of at least membranous inflammation; perhaps even cerebritis itself. It has, indeed, been generally believed that mere meningitis, either within the cranium, or of the spinal cord, will occasion morbid excitement of the nerves which issue from the part affected, although the medullary substance may not be implicated in the inflammatory affection. Such a supposition is not altogether improbable; and if true, then, it is easy to comprehend that vascular congestion of the neurilema, which is but an extension of a membrane of the brain and envelops medullary filaments, which are also alleged to be an emanation from, or a continuation of, the fibres of the brain (although it has been a mooted point among French physiologists whether the brain terminates in nerves, or the nerves terminate in brain,) may also produce similar excitement in a nerve. The details of an operation performed upon a diseased nerve by Mr. John Hunter, in the presence of Sir E. Home who records the case, seem much to countenance this opinion; for upon dividing the nerve, such were

the size of the artery within its substance and the extent of the bleeding, as to require a ligature. There was, however, imbedded in the substance of the nerve a large tumour, which, at least, justifies a suspicion that there may have been some previous inflammation, upon which, or upon the irritating influence of the tumour, the symptoms may have depended. A less equivocal instance is that, related by Bichat, in which it would appear that mere venous congestion had occasioned the symptoms of excitement. "Je conserve," says this distinguished anatomist, "le nerf sciatique d'un sujet qui éprouvoit une douleur très vive dans tout son trajet, et qui présente, à la partie supérieure, une foule de petites dilatations variqueuses *des veines* qui le pénétre." We can scarcely doubt the competency of Bichat to discriminate between tortuous arteries and varicose veins, and yet a most respectable living author has, through inadvertence, given at least an imperfect, if not an incorrect account of this case calculated to leave the impression that it was one rather of arterial fulness than of varix, in these terms:—"That there is an increased flow of blood *to the part* in these painful nervous affections is not only shown by the redness and arterial action, but has been proved by an interesting dissection made by Bichat, of a case of painful affection of the sciatic nerve, where the vessels of the neurilema were evidently enlarged in size, and increased in number, so as to be quite tortuous." The difference in these two statements is obvious; and Bichat's more minute and accurate account justifies the argument, that since varicose veins can produce severe pain throughout the whole course of a nerve so large and important as the sciatic, arterial congestion, without inflammation, may produce similar effects.

The weight of testimony, then, is upon the whole in favour of the supposition that the state of the circulation in the vessels of the neurilema modifies the exercise of nervous energy; and it is probable that the functions of nerves may be influenced, also, by the state of the arterial circulation in surrounding parts. There is scarcely an instance of any

important plexus or single nerve proceeding to its destination without either surrounding, or crossing, or accompanying in its course, some large arterial trunk. This is well illustrated in the axillary, the aortic, the pulmonary, the cardiac, the coeliac, and the uterine plexus. All the intercostal nerves pass over the corresponding arteries and must be elevated by each impulse of the arterial circulation, as was demonstrated to me by Mr. Swan in the very simple experiment of blowing into the aorta of a minutely dissected trunk, when the intercostal arteries, distended by successive columns of air in imitation of the natural circulation, raised sensibly by their elevation the intercostal nerves; and to approach nearer to my own province, the par vagum in its course lies close to the carotid artery, and passes over and in contact with the subclavian upon the one side, and the arch of the aorta upon the other; whilst the two recurrents wind round the same large vessels before they proceed to the parts which they supply. This general law must be for some wise purpose; and it is hardly possible to resist the inference, that the ordinary offices of nerves are materially influenced by the movements of these contiguous arterial trunks; and if so, it is not irrational further to conclude that an excess of action in such vessels may produce an "exaltation of function" in the nerves which they so influence; but after all, probably, this influence is but a modification of "mechanical impulse."

The ordinary impulse of arterial action, however, probably promotes or assists only the ordinary functions of contiguous nerves; its excess does but increase those attributes. The effects are not morbid or anormal, the parts upon which the nerves are distributed being free from pain or muscular spasm, although there may be increase of heat and of secretion,—excepting, indeed, in cases where the nerve is diseased; then, the results are greatly modified; any thing that can increase the momentum of blood, under such circumstances, often producing neuralgic attacks or convulsive movements, just as pressure with the finger, as in the case com-

municated by Sir Charles Bell to Dr. Cooke, or the contraction of a muscle, as in Mr. Denmark's case, upon an inflamed nerve produced these effects.

But whatever may be said of the influence of vascular excitement of the nerve itself, or of contiguous parts, in producing an excessive development of nervous energy, there can be no doubt that *inflammation* of a nerve, whatsoever its producing cause, or in whatsoever part of the course of the nerve it may occur, may produce that effect; and I believe it to be a cause of much more frequent operation than is generally supposed.

I have already adverted to the difficulty, which must occasionally exist, in drawing the precise line of demarcation between simple vascular congestion upon the one hand, and actual inflammation upon the other. That the latter state, however, may and does not unfrequently exist we may safely infer from the nature of the producing cause, the peculiarity of some of the symptoms, and the appearances on dissection; and where we can obtain this combination of evidence, the symptoms always assume the character of excitement, unless or until the nerve has been destroyed by the inflammation, or the latter has subsided or become subdued. Who, for instance, when neuralgia or convulsive movement is produced in the finger by a prick from the thorn of a gooseberry-bush, as in the case related by my friend Mr. Wardrop; by an angular piece of porcelain imbedded in the lip, as in that recorded by Mr. Jeffries; from pouring an undiluted acid upon the sciatic nerve, or transfixing with a needle the nerves of the fore-leg of a dog, as in the experiments of M. Bichat, can doubt that these agents must have occasioned neuralgia by producing inflammation of the nerve, or at least of its enveloping and connecting membrane? for it has been questioned by some whether the medullary matter be subject to such diseased action. Without, however, entering minutely upon this question, which I shall have presently to consider, I shall content myself, for the present, with the assertion of my belief in the affirmative.

Symptoms of Inflammation.

Besides the ordinary and general symptoms of excitement, inflammation of a nerve commonly presents some, which are peculiar. Amongst the most prominent of these are *pain and tenderness* in the course of the nerve affected. In the case of neuralgic affection which I have related, the sciatic nerve in the progress of the malady became affected, and, wherever it could be reached in its course, it was tender to the touch. In the instances of ischias nervosa, in the well-known dissertation of Cotugno,⁴ as well as in those more recently described by M. Martinet,⁵ there was tenderness in the nerve, in which dissection proved the existence of inflammation. In the interesting example recorded by Mr. Earle, "the course of suffering marked the nerve affected; the pain with heat and fulness, established the existence of excitement; and *the morbid sensibility, when touched*, of the whole course of the ulnar nerve, *proclaimed the existence of an inflamed state of that nerve.*"⁶ The patient was cured by excision of a portion when its inflamed condition was manifested in the appearance of the excited portion; for the "neurilema covering the nerve appeared firmer and thicker than natural." It is not stated whether the interior structure of the nerve was examined.

Similar evidence presented itself during life in the case, communicated by Sir Charles Bell to Dr. Cooke, of "partial palsy, with great debility, preceded by inflammation of a nerve, accompanied with excruciating pain." The inflammation was in the ulnar, and fibular nerves, and "the pain, which was of the most agonizing kind, had quite subdued a powerful frame. Observing that the pain was confined to certain parts of the hands and feet, and that a distinct class of muscles were become paralytic and shrunk, Mr. Bell's attention was directed to the corresponding nerves, and he found them *tender and acutely sensible* to the slightest touch."⁷ The existence of inflammation was thus detected by the *peculiar symptoms*; anti-inflammatory remedies were employed,

⁴ Sandeford's Thesaurus.⁵ Revue Méd. 1824.⁶ Med. Chir. Tr. vol. vii.⁷ Cooke on Palsy, p. 98.

and the patient cured without an operation. These characteristic symptoms, however, cannot always be traced, for the inflammation may exist, although at too great a distance from the seat of the symptoms, or too remote from the surface, to be within reach.

Occasionally, also, as in some of the instances recorded by Martinet, the nerve may be felt *swollen and hard*, as well as exquisitely tender to the touch. In one case the cubital nerve swelled to a considerable size, equal to that of the little finger, and felt like a tense cord along the arm. It remained swollen, rigid, and painful, for four months. In a second case, also, the cubital nerve could be felt enlarged and tense, especially between the elbow and the arm-pit. In a third, the radial nerve was felt tense and somewhat enlarged. In these nerves the enlargement was traced during life on account of their superficial situation: the sciatic, though enlarged to the size of the fore-finger, cannot be traced on account of its depth; but we may content ourselves in such cases with the proof, which excruciating pain, produced by pressure, affords us.

Structural Changes consequent on Inflammation.

Dissections of nerves, after operations or after death, often verify the suspicions, which the symptoms, before these events, had led the practitioner to entertain; and the appearances are said to vary according as the inflammation is confined to the neurilema, or extends to the medullary substance itself.

Amongst the results of inflammation of the neurilema may be mentioned the *deposit of lymph, producing thickening and induration of the nerve*. This deposit of lymph amongst the fibres of a nerve has been particularly noticed by Mr. Swan, as the consequence of its being included in a ligature, and as occurring in the chronic inflammation of the extremities of nerves in stumps, in which, "after a perpendicular section of the nerve and tumour, the nervous fibrils may be traced down to the tumour, and coagulable lymph seen to have been deposited between them." This enlargement and hardness from inflammation were very strongly marked in the

nerves of three cases of ulcerated limb, described by Mr. Swan; and equally so in some of the cases of inflamed nerve related by M. Martinet. In one the cubital nerve, swelled to a considerable size, was as large as the little finger; in a second, the cubital nerve could be felt enlarged and tense, especially between the elbow and the arm-pit; in another, the sciatic nerves on both sides were enlarged to the size of the fore-finger, being also hard and resisting; in another, the right sciatic nerve was increased to double its natural size, through an extent of an inch and a half; and in all these cases not only was the pain excessively severe, but the nerves were exquisitely tender throughout their course. M. Gendrin, also, in his highly philosophical work upon inflammation has noticed a similar change in a case, which he has related, of inflammation of the sciatic nerve; in which, through an extent of two or three inches, the nerve had acquired three times its average thickness.⁸

These deposits of lymph, occasioning thickening and hardness, may take place either upon the surface, or in the interior of the nervous cord, or more commonly in both. In some instances, where it has been confined to the surface, it seems to have strangled the nerve by pressure, and impaired its function; and hence probably, the explanation of those comparatively rare instances in which a nerve, apparently thickened by inflammation, has become enfeebled rather than excited; agreeably to an observation of Galen, that “a nerve, if rendered thicker and harder than usual, will prevent the transmission of nervous influence, just as the sun’s rays are intercepted in their passage through air by mists, smoke, and clouds, and through water by mud and clay.”⁹

When, however, these inflammatory deposits of lymph take place in the interstices of still existing medullary filaments,

⁸ Hist. Anat. des Infl. tome ii. p. 144.

⁹ Quippe in aere nebula et fumus et nubes, in aqua lutum et limus, solis splendorem, quo minus per ea syncerus procedat, impedimento sunt ac vetant. Ad eundem igitur modum et nervus, si crassiore habitu et duriore quam pro sua natura sit reductus, virtutis transitum prohibebit.—De Symp. Causis. lib. i. cap. 5.

the symptoms are generally, if not universally, those of excitement ; but it may be questionable whether, in such cases, the medullary matter itself may not have partaken of the inflammation, or at all events the processes of neurilema which dip between and separate the medullary filaments.

As in other textures of the body, so in nerves, *permanent redness*, observable even after death, is often the result of inflammation. In one instance related by Martinet, the left median nerve was of *a deep red colour, internally as well as externally* ; in another, the sciatic nerves were penetrated by a multitude of small vessels, which gave *a red appearance to the nerves* ; in another, the sciatic nerve, which was the seat of pain, *was of a red colour from the hip to the ham* ; in another, the sciatic nerve was *of a violet colour*, and ecchymosed ; in another, the sciatic nerve appeared of a *brown colour*, for the space of two inches, both externally and internally.

This redness may be merely upon the surface, but I believe it much more commonly extends to the neurilematous *septa* of the nervous fibrils ; and accordingly Gendrin found that upon macerating an inflamed nerve in an alkaline solution, and thus destroying the nervous pulp, he exposed the little neurilematous tubes, which *were injected with blood* both upon their interior as well as upon their exterior surfaces.

In neuritis, *other inflammatory deposits*, besides lymph have been occasionally observed. In some of the dissections of inflamed nerve, the record of which by M. Martinet contains ample internal evidence of his accuracy and fidelity, *serous infiltration* was particularly noticed. In the case in which the sciatic nerve was as large as the fore-finger, all the filaments of these nerves were distinctly visible, and separated from each other by a sero-sanguineous infiltration. In one instance blood itself had been effused between the fibrils and could be squeezed out by pressure ; and in two instances *pus* had been deposited between the filaments. Suppurative inflammation is not so common as the other changes enumerated, but its existence is conclusively established by these two cases in the very valuable memoir, by M. Martinet, “ Sur l’Inflam-

"*mation des Nerfs*,"¹ corroborated as they are by a fatal instance related by Sir Everard Home, of suppuration after an operation for the removal of a tumour from one of the nerves of the axillary plexus.² That such effusions are the consequences of inflammation, is almost self-evident. The effusion of lymph, in whatever organ or texture of the body it occurs, is universally considered conclusive as to the existence of that state; the colour of the effused serum excludes the idea of its being mere dropsy, and establishes its dependence upon increased arterial action; and the secretion of pus or sanies by the vessels of the neurilema needs no observation to prove its inflammatory origin.

Some have questioned whether this inflammation can extend to the medullary filaments themselves; but the presumptive and positive evidence upon the subject, in my estimation, far outweighs the difficulties and doubts, which some may have felt or entertained upon the subject. The presumptive proofs are derived from a consideration of the structure of these filaments, of the functions to which they contribute, and the analogy of diseases of the brain and spinal marrow. It will be readily conceded, that all parts upon which blood is distributed are susceptible of inflammation; and if it can be proved, therefore, that the medulla of nerves is vascular, we may predicate the occasional occurrence of inflammation of that texture. The statements of different writers upon this very difficult point of minute anatomy are not very precise or clear. Bichat, indeed, describes the vessels of nerves as pursuing a serpentine course upon the neurilematous investiture of the separate filaments; then penetrating the membrane, and continuing their course, together with the filaments, to the medullary substance; a disposition which, as he represents, is most obvious in the spinal marrow. In this part of the nervous system, after ramifying extensively upon the pia mater, which has a near relation to the neurilema, the vessels dip into the medullary substance and are there lost, as they

¹ *Revue Médicale*, 1824.

² *Tr. of a Soc. for the Improvement of Med. and Chir. Knowledge*, vol. ii. p. 157.

are continued with the exhalants.³ Meckel says, the blood-vessels are large and numerous in proportion to the nerves which they supply; they generally enter nearly at a right angle with the trunk of the nerve, then divide into ascending and descending branches, which are tortuous in their course, subdivide into numerous ramifications, *penetrate the tissue of the nerve*, and anastomose freely not only with each other, but with the contiguous branches; the frequency of these anastomoses and the great number of blood-vessels having for their object to prevent the slightest interruption to the circulation. This, he adds, is a disposition which prevails in every part of the nervous system, and is strikingly exemplified in the cerebral circulation.⁴

It thus appears to be established that the medullary substance of nerves receives blood from the vessels of the neurilema; but if further proof be required, it may suffice to refer to the change of colour in the nervous matter itself consequent upon inflammation, and ascertained, as in the experiment of Reil, by dissolving in acids the neurilema, and thus insulating and exposing to view the medullary filaments; and still more conclusively to one of the cases, recorded by M. Martinet, in which the filaments were penetrated by a multitude of small vessels, which gave the red appearance to the nerves.

It is a general pathological principle admitting of few exceptions, that when the function of a given part, organ, or tissue is long and continuously impaired, the diseased condition, be it either functional or structural, is in the part, organ, or tissue affected. Now, the observations and experiments of Haller and Bichat satisfactorily demonstrate that the sentient principle is exclusively confined to the medullary filaments, and does not extend to the neurilematous covering, which is but the matrix upon which the vessels ramify before they supply those medullary filaments: thus performing an office similar to that, to which, within the cranium, the pia mater—of which the neurilema is but a continuation—is subservient, and acting as a sort of cushion for the protection of

³ Anat. Gén., vol. i. p. 154.

⁴ Manuel d'Anatomie, vol. i. p. 249.

those filaments.⁵ The French anatomist enters more into detail than Haller. Having asserted, with truth, that sensibility exists principally in the medullary substance of each nervous filament, and that the neurilema has little sensibility, he adds that this is the reason why simple contact, without compression, with a nerve is little painful; why a nerve may, almost with impunity, be bathed in purulent matter, in an ichorous fluid, or even the sanies of cancer; why the contact of air is little perceived when the nerve is simply exposed without separating its enveloping membrane; and why, in a variety of cases, different tumours, situated immediately contiguous to nerves, produce no influence upon the latter, the membrane in each of these cases protecting the medullary substance, which is eminently the seat of sensibility. As to the cellular tissue, which enters into the composition of a nerve, it is nearly devoid of the property of sensibility. Hence it is that, according to the experiments, in the living animal, frequently repeated by Bichat, the fibres of a nerve may be insulated, and separated from each other with a very fine scalpel provided they are simply exposed and not deprived of their neurilema, the animal being little sensible of it. In these experiments, Bichat further adds, it is easy to convince oneself of the degree of sensibility belonging to the *envelope* of each nervous filament. “Il faut la traverser, et arriver à la substance médullaire, pour produire de la douleur.”⁶ Since, therefore, the medullary substance, to the exclusion of its enveloping membrane, is the seat of sensibility, the exaltation of this function in cases of inflamed nerve, manifest in the excruciating pain which attends it, affords strong presumptive evidence that such medullary matter is the seat of the disease.

The analogy of the diseases of the brain and spinal marrow is, also, greatly in favour of the supposition that the medulla

⁵ “Sed nervi sentiunt et soli quidem sentiunt. Est autem nervorum medulla sola quæ sentit.”—*Elem. Phys.*, vol. iv. p. 312.

“La membrane de chaque filet est véritablement, une espèce d’abri qui protège sa substance médullaire, dans laquelle siège éminemment la sensibilité.”—*Anat. Gén.*, tom. i. p. 162.

⁶ *Anat. Gén.*, vol. i. p. 163.

of nerves may be inflamed. Scarcely any one now hesitates to admit that the medullary substance of those important subdivisions of the nervous system is liable to inflammation; but if a doubt upon the subject could still lurk in the mind of the most incredulous, the "pathological researches" of Dr. Abercrombie, and the work of M. Ollivier upon the diseases of the spinal marrow, should altogether dispel that doubt. These important organs have a direct connexion with the nerves by continuity of substance, by similarity of structure, and identity of office, and we might safely infer that both would be subject to the same diseases; and this is conclusively established by inflammation producing the same organic changes in all.

In proving the existence, and tracing the consequences of inflammation of nerves, I have alluded to one very common change—that of the effusion of lymph, attended with thickening and induration. I believe this to be the result principally of inflammation of the membranous investiture of the filaments, though, from what is often observed in the brain, it is far from improbable that the medullary substance itself may partake of the change. In encysted abscess of the brain there can be little doubt that, as in other parts of the body, the cyst, which insulates it, is the result of the deposit of lymph which becomes organized and, in some instances, constitutes "a firm white membrane,"⁷ although in general it is not so well defined. The induration, also, occasionally observed in epileptic patients, and in maniacal cases⁸ is probably from a similar deposit, which becomes organized. At all events, Andral,⁹ whose opinion upon the subject is much corroborated by M. Bouillaud¹ considers both the general and partial indurations of the cerebral substance as the results of inflammation—the former of its acute, the latter of its chronic form. Morgagni has recorded no less than fifteen instances of induration occurring principally in maniacal or epileptic sub-

⁷ Abercrombie's *Pathological Researches on the Diseases of the Brain*, &c. p. 101.

⁸ Meckel, Manuel, &c. vol. i. p. 288.

⁹ *Précis d'Anat. Pathol.* vol. ii. p. 808.

¹ *Archives de Médecine*, tom. vii.

jects. The majority of these were attended with increased vascularity, some with alteration of colour, and some with serous effusion,—appearances abundantly characteristic of previous inflammation.² Lieutaud quotes, amongst numerous instances, one from Fournier, in which a portion of brain as large as a fist, was of a stony hardness.³ In two instances also, (all that he has recorded) of chronic inflammation of the brain, noticed by Dr. Abercrombie, a portion of the brain was firmer than natural.⁴

M. Andral describes three degrees of this induration of brain : in the first, it is like that of a portion of brain which has been long steeped in diluted nitric acid ; in the second, the indurated portion is like wax, or Gruyère cheese ; in the third, it has the consistence and elasticity of a fibro-cartilaginous substance. In diseases of the brain these various degrees may be traced, as the accompanying increase of vascularity or irritation, amounting, according to Andral, Bouillaud, and others, to “*encéphalite*,” may destroy the patient in any of its various stages. In nerves, also, such induration occurs, and there is strong reason to believe in the same varied degrees. But the diseased part is seldom examined until the long continuance of agonizing pain has tempted the patient to submit to an operation, or death has closed the scene ; and, then, the swelling of the nerve has commonly assumed a circumscribed form, and is of a fibro-cartilaginous hardness ; blunting, as Meckel has observed of the inflamed nerves of stumps, the knife which cuts it, and producing a sound in cutting like that of cartilage.

The change of colour also, in an inflamed brain, is very similar to that noticed by M. Martinet, Reil, and others, in inflammation of nerves. The “*dark red colour*” mentioned by Dr. Abercrombie in two cases of inflammation of the cerebral substance, “*fatal in the inflammatory stage*,” with “*the bright red colour*” in the portion of brain near to the surface,

² Epist. Anat. i. v. viii. ix. x. xxiv. lxi. lxii.

³ Ita indurata ut lapidis duritiem mentiretur. Hist. Anat. Med. lib. iii. obs. 84.

⁴ On Diseases of the Brain and Spinal Marrow, p. 79.

which seemed firmer than natural; the "*deeper red colour*" of "a similar portion deeper in the substance of the brain," and "*the red colour approaching to purple*" of the corpus striatum, in his only instance of "the affection in a chronic form," are very similar to the "*couleur d'un rouge foncé*" the "*rouge violacé*," the "*couleur violacée* in nerves, of M. Martinet,⁵ the *couleur rouge ou violacée*," of M. Gendrin.⁶

The most characteristic change, however, consequent upon inflammation of the medullary substance of the brain and spinal marrow, is "*ramollissement*," of which endless examples might be accumulated. The same change of texture is not very unfrequently seen in nerves, and, as in the brain, is probably nearly allied to gangrene. When a question can arise as to the vascularity of a part, at all events the vessels must be few and minute. There is no doubt as to the vessels being numerous in the neurilema, but they must be very small in the white medullary filaments; and this slight vascularity renders these little able to bear active inflammation. Like the cornea of the eye and tendons of the extremities, which are peculiarly prone to slough when inflamed, nerves, when their medulla is implicated, are also apt to become gangrenous; and hence the *ramollissement* of nerves consequent on inflammation. In the interesting example, related by M. Serres, of epilepsy depending upon chronic disease of the brain, which was very extensively disorganized, the patient having also a local palsy from disease of the ganglionic or sentient portion, to the exclusion of the motor branch of the fifth pair, "the nerve was found soft, yellowish, and almost like jelly; the same change of texture extending a line or two into the substance of the annular protuberance."⁷ In another instance related by M. Gallereux, after a continuation of blindness of one eye for six months, the optic nerve, through half its extent, had lost entirely its consistence, being reduced to the state of a fluid of a whitish colour.⁸ This

⁵ Mem. sur l'inflammation des nerfs, Rev. Méd. 1824.

⁶ Hist. Anat. des inflammations, tom. ii. §. 1050.

⁷ Archives de Médecine, vol. v. Quoted also by Descot, Bell, and Andral.

⁸ Journal de Sedillot, tom. i. Quoted also by Descot.

change was probably the cause of the blindness, for the appearance was altogether different from that of the atrophy of a nerve, which is consequent upon the loss of the organ which it supplies. There is in the cases of the latter kind of "atrophy" no softening of texture, but the nerve is often diminished to a fourth or fifth of its natural size; the medullary substance disappears; there is only a gray semi-transparent matter in its interior; sometimes the neurilema is even thicker and more consistent than natural; the nerve looks like a fibrous and almost cartilaginous cord, and sometimes nothing remains but mere cellular substance.⁹

Suppurative inflammation of nerves, to which I have already adverted as the result of inflammation of the neurilema, bears a very striking analogy in its character to the undefined suppuration from inflammation of the brain, described with such accuracy by Dr. Abercrombie, who represents the part of the brain affected in one case, as "reduced to a mass of fœtid pus;" and in a second, says that "the whole of the posterior part of the left hemisphere of the brain was one mass of undefined suppuration." This resembles strongly Martinet's seventh case, in which three inches of the sciatic nerve were infiltrated with purulent matter, which penetrated amongst its most minute filaments; as well as another instance, communicated by M. Goupil, in which the left sciatic nerve was bathed, as it were, in sanious pus, which was also found amongst its fibrils.¹

One other consequence of inflammation may be noticed, as common both to the nervous centre, and to individual nerves—*ulceration*. Two interesting examples of this morbid condition within the cranium are referred to by Dr. Abercrombie: in the one, under the anterior lobe of the right hemisphere, "there was a superficial ulcer, measuring thirteen lines by seven;"² in the other, "there appeared upon the upper surface of the cerebellum an ulcerated superficial excavation, the size of a shilling, containing an ichorous matter."³ In nerves,

⁹ Andral Précis d'Anat. Pathol. vol. ii. p. 871.

¹ Rev. Méd. 1824.

² Scoultatten, Arch. de Méd. 1825.

³ Howship, in Med. and Phys. Journ. March 1810.

also, ulceration has been occasionally traced. It has been distinctly recognised by Mr. Swan; but the examples of this state recorded by him are more prominently instances of thickening from inflammation, than actual ulceration; or, at all events, the phenomena are those of the former rather than of the latter state. In one, indeed, of the three cases related by Mr. Swan, there was distinct evidence of ulceration in the dorsal branch of the peroneal nerve; "an inch of this appeared rather smaller, and in a state of ulceration, and in one place nearly divided."⁴ The extent of ulceration, however, in this example, confined as it was within such narrow limits, affords no satisfactory explanation of the symptoms, which presented themselves in other parts of the limb, and far above the seat of the ulceration. The pain of which this patient complained, and for which, on account of its violence and extent, he readily submitted to amputation, was in the course of other nerves "in the thigh and leg as far as the ankle." Dissection of the limb after its removal cleared up all obscurity, for there was scarcely a nerve of the limb which had not been considerably enlarged by inflammation. In neither of the other instances recorded as having occurred within the observation of Mr. Swan, was there, as he candidly admits, any ulceration of nerves, although they have been introduced into his chapter on that subject; but in these, as in that of William Sharpe, it was evident upon dissection that the nerves had become inflamed, and that this had given rise to the symptoms. *In one case only* was there ulceration;—*in all* the appearances of previous inflammation were manifest; the phenomena common to all were those, which are notoriously the result of inflammation from whatever cause arising; and to this morbid condition, therefore, common to them all, the symptoms should have undoubtedly been referred. The case quoted from Morgagni is an unequivocal instance of ulceration; for upon examining the limb, a few fibres of the nerve only remained by which parts above and below the ulcerated portion preserved their communication:—but as I shall have occasion to revert to this case hereafter

⁴ On the Diseases of Nerves, p. 69.

for another purpose, I shall then consider more at large the symptoms and their cause. I may content myself for the present, 1st, with stating that the explanation offered by Mr. Swan differs materially from that of Morgagni himself, and does not seem to me to be altogether satisfactory; and, 2ndly, with pointing at the resemblance between the state of the brain, in which, in the case of my able colleague, Mr. Howship, "there appeared an ulcerated superficial excavation containing an ichorous matter," and that of ulceration of nerves, "some of which are unusually soft and easily torn," one of which "was in a state of ulceration and nearly divided," and another "so much eroded that a few fibres hardly remained."

The concurrent testimony of all the principal writers upon the diseases of nerves, including Descot, Martinet, Jolly, Gendrin, perhaps Abercrombie, and Swan, prove that the changes which I have described are the ordinary consequences of inflammation; and they appear conclusive as to the occurrence, not only in the neurilema, but even in the medullary filaments themselves, of that pathological condition, the existence and treatment of which were not altogether unknown to Galen, who says, upon this subject, "*Quin et nervo inflammato pauci spasma correpti sunt et mente alienati, quorum quidam sic affecti, cum sapientiore medicum nacti essent, nervo inciso, spasma et mentis alienatione liberati sunt; sed postea musculum, in quem nervus insertus erat, insensibilem, atque inutilem ad motum, habuerunt.*"⁵

This inflammation of nerves, it is said, may be either acute or chronic; but the distinction between the two has not been drawn with precision or accuracy. Both are represented by Mr. Swan as generally taking place "in nerves contiguous to inflamed parts;" and they may therefore partake of the character of the inflammation by which the nerve affected is surrounded.

An attempt has, indeed, been made by M. Gendrin to distinguish these two forms of inflammation by the pathological appearances which they present, and he enumerates, as the anatomical characters of his first degree of acute inflammation,

⁵ De Motu Musculorum, lib. i. cap. 1.

a bright red colour and swelling of the nerve, separation of its filaments from each other, increased vascularity of the neurilema—greater as it approaches to the centre of the inflammation—a close vascular net-work extending to the central filaments of the nerve, with great vascularity and serous infiltration of the interstitial cellular tissue; and to these positive, he adds as negative characters that the nervous pulp has undergone no appreciable change, the medullary filaments are not increased in thickness but preserve their natural condition, the vascularity, infiltration, and swelling being confined to the neurilema and cellular tissue which connects the nervous filaments.⁶ When the inflammation is in a more intense degree, the nerve, he says, is of an uniform brownish or violet red colour; pure blood is extravasated and infiltrated in the neurilema; the nervous cord is swelled, appears homogenous in texture, and is less dense than in its natural state; the vascular network is now only perceptible at the very boundaries of the inflammation; the nerve is easily lacerable either transversely or in the course of its fibres, has a spongy texture red in colour, resembling a cord of inflamed cellular tissue; a transverse incision exhibits the pulp as a half-fluid red material forming points in the substance of the nerve. At the borders of the inflamed part the nervous pulp is obviously red, apparently softened, and resembles small tubes filled with blood. As we recede from the inflammation towards the part where the injected state of vessels begins to disappear, the nerve has the appearance of having been dissected; its filaments seem to be separated from each other by serous infiltration; and there is a total disappearance of the little adipose cells in the cellular tissue which surrounds, or which penetrates the substance of the nerves.⁷

The anatomical characters of chronic inflammation, which he briefly enumerates, are, 1st, augmented density of the texture of the nerve; 2ndly, injection of its vessels and thickening of its neurilema; 3rdly, induration of the nervous cord, the texture of which, however, may be easily broken down; and

⁶ Hist. Anat. des Inflammations, § 1049.

⁷ Ibid. § 1050.

4thly, dilatation of its proper vessels, with infiltration and considerable induration of the interstitial cellular tissue.⁸

M. Gendrin has certainly here made the most of his, perhaps, rather scanty materials; and although, possibly, some allowance should be made for a little disposition to refinement, it must be allowed that there is much of accuracy in this enumeration of the discriminating marks not only between acute and chronic inflammation of a nerve, but even between the different degrees of the acute form of neuritis. It results, from this account, that active inflammation begins in the neurilema and cellular tissue, that to these textures in its first degree it is restricted, and that in its progress it extends to the medullary filaments, when the texture of the nerve is softened:—whilst chronic inflammation, although it so changes the substance of the nerve as to occasion its being broken down by slight force, (*friable*,) yet it has considerable increase of density, thickness, and vascularity, probably the consequence of what is commonly called adhesive inflammation. It is obvious, however, that these several stages of inflammation run into each other by insensible degrees, and are far from being so distinct, as they are represented by M. Gendrin; and, at all events, as the symptoms are very similar in all until the nerve is destroyed by ramollissement, as the distinction, so far as that is founded upon these pathological changes, can only be ascertained after death or by dissection, and as they all require similar treatment, the discrimination, which is not easy, is perhaps, after all, of no great moment.

Causes of Inflammation.

Inflammation may be produced by a variety of causes, amongst which may be enumerated *exposure to cold*, as exemplified in the painful affections of the face which occasionally arise from that cause. It is, however, in my estimation very doubtful whether in these cases the direct impression is made upon the nerve. It appears, upon the whole, more probable that surrounding textures are first attacked, and that the

⁸ Ibid. § 1073.

nerves become implicated by simple extension of disease. It is rare to observe, from such cause, the affection of nerve without preceding swelling of the face; whilst the swelling of the face is of every-day occurrence, without being attended or followed by any neuralgic affection.

The symptoms vary according to the nerve which is affected. The sensitive branches of the fifth pair, being the most superficial, are most liable to inflammation; and hence the frequency, from such exposure, of tenderness of the cheek, teeth, jaws, and even complete facial neuralgia, which generally subside with the subsidence of the inflammation. Sometimes the portio dura has been affected, either primarily or secondarily, when convulsive movements supervene, as has been remarked by M. Jolly with respect to the "*névralgie sous-orbitaire*," which, he says, is sometimes accompanied with convulsive movements of the lower eye-lid, the cheeks, and the upper lip; and in the "*névralgie maxillaire*," which is often attended with partial convulsive movements, producing deformity of the mouth and eye-lids.⁹ Still more frequent examples of the direct influence of cold in producing neuralgic complaints will be found in that form of ischias, first particularly noticed by Cotugno, under the appellation of the "*ischias nervosa*."¹ This is constantly the result of exposure either of the whole body when heated, or of the part itself—as in sitting upon damp grass—to cold; and the symptoms, treatment, and dissection, all tend to prove that, in such cases, both the neurilema of the nerve and, frequently, the medullary filaments themselves are inflamed.

M. Martinet, in his very interesting memoir on Inflammation of Nerves, has given a striking instance of the influence of cold. It is stated that pain in the course of the right sciatic nerve began soon after exposure to cold when in a state of perspiration; and dissection exhibited an inch and a half of the nerve thickened to double its natural size, of a violet colour, and dotted with ecchymoses; the neurilema connecting

⁹ Diction. de Médecine et de Chirurgie pratiques. Art. Névralgie.

¹ Sandefort's Thesaurus.

the medullary filaments being in a state of congestion and inflammation.²

The ulnar nerve, also, from its superficial situation, is subject to a similar malady from the same cause, the frequent operation of which in occasioning neuralgia has been particularly noticed by M. Jolly. "Les individus qui, par état, sont habituellement soumis aux effets du froid et de l'humidité, tels que les pêcheurs, les marins, etc. ceux qui habitent des contrées marécageuses, qui s'exposent à l'impression d'un vent froid et piquant, à l'effet des vicissitudes atmosphériques, sont particulièrement exposés aux névralgies. En cela, l'axiome si connu des anciens : *'le froid est l'ennemi des nerfs'* est d'une exactitude parfaite."³

Mechanical violence is no unfrequent cause of inflammation of nerves, and this whether the injury be a contusion, or consist in the partial division of a nerve by a pointed or cutting instrument. A blow upon the eye-brow has produced tic douloureux in all the parts supplied by the supra-orbitary branch of the fifth pair.⁴ A laceration of the scalp by a fall from a horse, implying some contusion of the nerves, has produced "head-ache and pain along the course of the nerves on one side of the head, a tenderness and indescribable sensation on the scalp, a puffing of all that side of the face, and swelling of the eye-lids of the same side."⁵ A gun-shot wound of the arm, implicating the biceps and coraco-brachialis muscles, as well as the radial and internal cutaneous nerves, has caused severe neuralgia, afterwards attended with convulsive movements.⁶ An injury, also from a gun-shot wound, upon the outside of the leg, has been the cause of very severe neuralgia, with convulsive movements of the limb, which continued eight years, until relieved by the division of the nerve.⁷ Of a similar kind is the interesting example of "symptoms resembling tic douloureux, from a wounded nerve, related by Mr.

² Rev. Méd. 1824.

³ Art. Névralgie, in Dict. de Médecine, par MM. Andral, Béjin, &c.

⁴ Swan, p. 24. Pouteau Œuvres posthumes vol. ii.

⁵ Bell on Nervous System, App. xvii.

⁶ Campagnes de M. Larrey. Descot, p. 82.

⁷ Descot, on the authority of M. Ribes, p. 83.

Denmark.⁸ The fragment of a musket ball, lodging amongst the posterior filaments of the radial nerve, "produced such exquisite torture" as to induce the patient not only cheerfully to submit to, but even to court amputation, which afforded some chance of relief to his suffering. "A small tumour could be felt in the site of the wound on the anterior part of the arm, which he could not bear to be *touched* without evincing additional torture. He described the sensation of pain as beginning at the extremities of the thumb and all the fingers, except the little one, and extending up the arm to the part wounded. It was of a burning nature, he said, and so violent as to cause a continual perspiration from his face." "His agonies, he observed, were insufferable, depriving him of sleep, and the enjoyment of his food." "The little sleep he had, if it could be called such, was disturbed by frightful dreams and starting." All movement gave him great pain; but he had little control over the action of the muscles. The fore-arm was constantly bent in a supine posture, and supported by the firm grasp of the other hand; the wrist was also bent, being unable to move it in any other position by the voluntary exertion of its own muscles. He could bear the extension of the hand, but with increased pain. It always, however, upon the removal of the extending power fell into its former bent situation. The act of pronation he could also bear to be performed by Mr. Denmark, but in like manner with increase of pain. Amputation above the elbow gave instantaneous relief, and he was discharged from the hospital (Hasler) cured in three weeks, having in that time rapidly recovered his health and strength. On dissecting the arm, "the radial nerve was found *blended with, and intimately attached to, the wounded parts, for the extent of an inch*. It had been wounded, and at the place of the injury was "*thickened to twice its natural diameter*," and seemed as if contracted in its length. A small portion of the ball, which had been driven off by grazing the bone, was firmly imbedded amongst the fibres in the posterior part of the wounded nerve. "The nerve was *evidently thickened* both above and below the wound."

⁸ Med. Chir. Trans. vol. i. iv. p. 48.

This case presents to our notice several points of very considerable interest. It is clear, in the first place, that the symptoms were not the result either simply of the mechanical injury, or of the mere lodgment of the fragment of ball amongst the filaments of the nerve; for after receiving the wound, a considerable interval elapsed before the symptoms occurred. "The wound soon healed, and without manifesting any particular symptoms during the cure." The period which elapsed between the infliction of the injury and the occurrence of the symptoms is not mentioned by Mr. Denmark; but in one of the two cases just referred to, eight days, and in the other eighteen elapsed after receiving the wound, before the symptoms of inflamed nerve manifested themselves. Secondly the sensations of the patient presented the well-marked characters of inflamed nerve. Such was the inordinate sensibility, that the torture from touching the tumour was exquisite; the pain also at other times being such, that "the largest doses of opium could not assuage it," and it was "of a burning nature;" and, lastly, the case seems to confirm the principle so amply and aptly illustrated by Sir Charles Bell, Magendie, and others, that the fibrils of sensation are, throughout their whole course, distinct, though contained within the same external covering, from those of motion; for it does not appear that there were any convulsive movements throughout the progress of the disease, although "the symptoms resembling tic douloureux" were so insupportable. Upon the whole the case is an admirable illustration of inflammation of a nerve, producing its ordinary symptoms, occasioned by severe mechanical violence done to the nerve itself.

Ligatures upon nerves may be considered as modes of mechanical violence, nearly allied to contusions. If these are so thick as not completely to destroy the continuity of the nerve or to intercept altogether the transmission of nervous influence, the symptoms during life, and the appearances upon dissection after death, or after a surgical operation implying the removal of the injured portion, abundantly establish the existence of inflammation. This appears from the experiments of Swan, Descot, and others, and from the occasional results

of some operations in surgery. In the experiments above adverted to, the almost invariable consequences of the application of a ligature around the trunk of a nerve were thickening, increased vascularity, and the effusion of coagulable lymph; but the most interesting illustrations are those which occasionally present themselves in amputated limbs, where the ligatures applied to bleeding vessels have, in the hurry, confusion, and want of proper assistance immediately after an action, or upon the field of battle, also entangled their accompanying nerves. In such cases the symptoms are often inordinately severe; the neuralgia is insufferable, the convulsions violent, and in some instances it would seem that even tetanus has been the result, and has been checked *in limine* by the removal of the ligature.⁹

Punctured wounds also afford illustrations of the effects of an inflamed condition of a nerve, and this even more frequently than contusions; for nature has generally taken care to protect nerves against the ordinary accidents of life, although they are not beyond the reach of such great violence as will fracture and splinter bones,¹ or of gun-shot wounds,² or of such sharp and penetrating wounds as the prick of a gooseberry thorn,³ an angular piece of porcelain,⁴ or the point of a lancet in one of "the occasional ill consequences of venesection."⁵

It was long thought, that, where a nerve suffered from a punctured wound, the symptoms arose from its partial division; and this opinion has received, to a certain extent, the sanction of one of our most recent and industrious writers upon the diseases and injuries of nerves. "If," says Mr. Swan, "a fibril be partially divided, or if it be wholly divided, and at the point of division it be connected with the adjoining fibril by filaments, the retraction of the divided parts will stretch these filaments, and thereby cause considerable pain." But a subsequent observation of this judicious author goes far to prove that his confidence in this speculative opinion is not implicit; and it seems scarcely to be borne out

⁹ M. Larrey.¹ Swan.² Larrey. Ribes.³ Wardrop.⁴ Jeffries.⁵ Abernethy.

even by his own experience, the results of which he thus states:—"By far the greatest number of injured nerves in venesection is made troublesome by using the arm too soon, and bringing on inflammation; for I have never seen any bad consequences in those patients who have been so ill as to be unable to do any thing." Soemmering was well acquainted with the fact, that nerves might be partially divided without being attended with serious results, and he must therefore have been equally aware, that the mere partial division could not have been the cause of the symptoms; but it is to the late Mr. Abernethy that we are principally indebted for the more correct views now entertained upon the subject. His acute and inquiring mind led him, "with the eye of reason as well as of observation," (to adopt one of his own eloquent expressions,) to see in the period which commonly elapses between the infliction of the injury and the appearance of its occasional serious consequences, time for, and the probable occurrence of, some intermediate state to which the symptoms should be referred. He was well aware that numerous instances occur, in which the nerve has been wounded in bleeding, without being followed by any particular symptoms. He also well knew that, when evil consequences are the direct result of an injury inflicted upon a nerve, and not of the more remote effects of that injury, they are synchronous with the infliction of the injury—as in cases of paralysis from completely dividing, or convulsive movement from pricking a nerve with any pointed instrument;—whilst in partially divided nerves from bleeding or other punctured wound, days commonly elapse before bad symptoms occur. It was therefore the opinion of this intelligent surgeon that in the interval, from exposure to cold or other causes, extrinsic or internal, "an inflammation of the nerve may accidentally ensue, which would be aggravated if it were kept tense in consequence of imperfect division;" and further, "that the disease consists in inflammation of the injured nerve; and that this inflammation may happen *with or without* total division of the nervous cord."⁶

⁶ Abernethy's Surgical Works, vol. ii. p. 161.

This opinion, which was with Mr. Abernethy but a shrewd conjecture, deriving confirmation, however, from the observations of Pott and Monro upon the same point, subsequent inquiries have essentially corroborated. The instructive cases of partially divided nerve collected by Mr. Swan, all tend to the same conclusion. In all, the symptoms were similar in kind, although they varied in degree; they were those obviously of excitement, as pain or convulsive movement; and commonly days elapsed, in one case even a fortnight, before the characteristic symptoms supervened. In one instance dissection conclusively established the nature of the malady, for "the finger being amputated, a small fibril of the digital nerve was found divided; the end of this next the tip was incorporated with the cicatrix; the other was formed into a small bulb."

But the total division of a nerve by a clean incised wound may be also followed by inflammation, which, in the form in which it commonly presents itself in stumps, is, according to Mr. Swan, chronic in its character; and this opinion is adopted by M. Descot. Such inflammation, according to Mr. Langstaff, generally arises from exposure of the cut extremity of the nerve either to atmospheric influence, or to contact with parts already in a state of inflammation, as during the healing process of stumps; and so confident is this eminent and original pathologist of the accuracy of the explanation, that he makes it the foundation of an important practical rule, of the propriety of which my information is too limited to entitle me even to form an opinion, (although it seems reasonable,) namely, that of drawing the nerves beyond the surface of the stump with a tenaculum and removing a portion, generally equal to half an inch, when the extremity of the nerve will recede beyond the reach of atmospheric influence, or, perhaps, of the surrounding inflammatory process. Mr. Swan much commends this practice, and strongly advises it in all cases of painful stump requiring a second operation, whilst Mr. Langstaff restricts his recommendation of it to those cases in which a sufficient quantity of skin cannot be preserved, and in which, therefore, the ends of the nerves are likely to be included whilst the cicatrization is going on. It is an additional ground

for commendation of this proceeding, that it does not appear to be very painful.⁷

Mr. Abernethy, as well as Mr. Swan and others, are of opinion that the exposure to air of denuded filaments is, in these cases, the cause of the inflammation. The impression of Bichat upon the subject was probably very similar. By experiments upon animals he ascertained that "when a nerve was simply exposed, without denuding its medullary filaments, it was little excited by the access of air, or by the agency of slight mechanical irritation; the membrane of each filament being, in such cases, a sort of protection to the medullary substance, which is peculiarly the seat of sensibility." "In these experiments," he adds, "it is easy to assure oneself of the little sensibility inherent in the enveloping membrane of each nervous filament. It is necessary to cross this membrane, and arrive at the medullary substance, to produce pain." Hence, reasoning *e converso*, it appears not unfair to conclude, that Bichat believed in the injurious effects of the exposure to atmospheric influence of the denuded medulla of nerves, and that amongst these pain would be a prominent symptom.

When this inflammation occurs in the nerves of a stump, it commonly produces a bulbous enlargement of their extremities. Meckel, indeed, asserts that all divided nerves have small bulbous tubercles near their extremity; but such as are the result of diseased action are of much larger size; and these, when influenced by compression or other mechanical violence, by atmospheric changes, or internal ailment, are apt to produce frequent and violent attacks of agonizing pains and excruciating spasms. When a student in the Borough, I witnessed a second amputation on account of this peculiar morbid condition. The united force of all the attendants was insufficient completely to control the struggling (apparently convulsive) of a child, not above thirteen years of age, when an attempt was made to steady the remnant of an arm by holding firmly the original stump. This bulbous enlargement of the extremity of a divided nerve has a peculiar character; "il est souvent si solide et si dur que le scalpel

⁷ Med. Chir. Trans. vol. xvi. p. 144.

s'émousse en le coupant, et fait entendre un bruit semblable à celui que produiroit son action sur un cartilage."⁸

Neuritis may also occur by simple *extension of disease* from contiguous tissues. A nerve, passing through a part which is the subject of inflammation, not unfrequently becomes implicated in the morbid condition of the surrounding textures; and this may happen whether the inflammation be simply phlegmonous, or specific in character. Professor Thomson remarks upon this subject, "In the neighbourhood of parts which had often been inflamed, I have observed that the nerves are sometimes more vascular and much thicker than usual;"⁹ and M. Delpech assures us, that, in cancerous diseases, nerves are apt to become thickened, and to take on the particular character of that disease.¹ It is probably to this cause, the extension of inflammation to the nerve in a cancerous ulcer, or even in cases of common inflammation, that much of the pain in these diseases may be owing. Blood, it is well known, may be collected in parts abundantly sensitive; there may be increased arterial action, accompanied with heat, as in blushing; nay, there may be actual inflammation of the cuticular tissue, as in erysipelas, and yet each of these states may be unaccompanied with suffering. But if phlegmonous inflammation attack the subcutaneous tissue, as in whitlow, the patient's sufferings, it is well known, are abundantly severe, and this because the disease implicates the very seat of the sentient extremities of the nerves. The pain of cancer, too, is very excruciating in a large numerical majority of instances; but I have recently witnessed the termination of a well-marked case of this disease in the breast, of a circular form and not less than four inches in diameter, which it was my painful duty to watch for above twelve months, and in which, throughout the whole course of the malady to its fatal conclusion, the pain rarely exceeded that of any other ulcer of equal depth and superficial dimensions. The explanation of this is not perhaps easy. This individual, however, was,

⁸ Meckel's Manuel, vol. i. p. 283.

⁹ Lectures on Inflammation, p. 153.

¹ Diction. des Sciences Médicales, art.—Cancer.

with the exception of her cancer, peculiarly healthy; and throughout the whole course of her malady there was little either of constitutional disturbance or surrounding thickening. No hardened lymphatics could be traced in the direction of the arm-pit, and there were no enlarged glands in the axilla. Much also of the progress of the complaint was to be ascribed to the separation of minute sloughs, rather than to what has been commonly called ulcerative absorption. These small sloughs probably destroyed the sentient organs as the disease proceeded; the nerves in the surrounding textures were little exposed to the extension of inflammation to their trunks, and the result was much less pain than usual. I offer this, however, only as a plausible and probable explanation of an unquestionable fact.

Mr. Swan, who has collected much valuable information upon this subject, considers that inflammation of nerves is commonly the result of the simple extension of disease from contiguous parts; and Descot confirms his opinion by adoption. "Nerves," he says, "are subject to inflammation, which takes place generally in those contiguous to inflamed parts. When a nerve partakes of the inflammation of the part in which it is situated, it becomes increased in size, from a deposit of coagulable lymph amongst its fibres." And again: "chronic inflammation of the nerves generally arises from a communication of diseased actions from surrounding parts, or sometimes from injuries."²

There is some confusion in the statements of even the best writers upon the subject of the symptoms of inflammation, when it is the result of extension of disease; and this has probably arisen from want of sufficient discrimination between the pain which arises from inflammation of the nerve and that from inflammation of contiguous textures; or between inflammation and its more remote consequences. Mr. Swan alleges that "it is generally attended by much pain, and a *paralysis*, or *imperfect sensation*, in the parts supplied by it;" thus imputing to the same morbid condition opposite effects, as "much pain, and imperfect sensation;"—and yet, in speaking

² On the Diseases of Nerves, p. 57.

of the chronic inflammation of the nerves in stumps, he adds, "when the nerves are in this state, the patient suffers so much pain, and *especially from the least touch*, as to be obliged to submit to a second amputation." At the first glance this may seem to be a contradiction; but it is an apparent only, not a real contradiction. Both statements may be true, and admit of explanation. Where the continuity of a diseased nerve is perfect, and the nervous influence is not interrupted in its course either by the destruction of the nerve itself or by the pressure of surrounding thickening, there is, from inflammation, increased sensibility through its whole course. So, in many instances of neuralgia the slightest touch of the part, a current of air or the movements of mastication will constantly excite a paroxysm. There is morbid sensibility, with heat and increased secretion, in the remote distribution of the nerve. But in other cases when the nervous influence is intercepted by any cause, there may be pain referred to the part upon which the nerve is distributed, as occurs also in stumps, and yet there may be paralysis of the muscles, and defective sensibility to the touch upon the surface. Dr. Hennen seems to have been aware of this distinction, which he illustrates by cases of secondary paralysis after gun-shot wounds, without immediate injury to the nerve; "as in those cases when a ball has passed so close to a large one or the plexus from which it proceeds, as to occasion an inflammation and consequent thickening of the neurilema or investing membrane; or where, in a more distant transit of the ball, the tube formed by its passage swells to an extent sufficient to press on the nerve or plexus." In the case also of David Franklyn, related by Mr. Swan, there was great pain in the wrist and palm of the hand, but the sense of touch in the thumb and three fingers was lost. The median nerve, where it passes under the annular ligament, was much enlarged, and *its natural connexion with the sheath* of the tendons of the flexor muscles of the fingers *thickened*. The cutaneous branches of the wrist and palm coming from an inflamed nerve, but escaping the pressure of contiguous parts, produced great pain; whilst the surrounding cellular connexion with the

sheath and tendons compressed the digital nerves, and, in conformity with what I have before advanced, strangled them in their course, and impaired their function of ministering to natural sensibility.

More unexceptionable instances of the effect of inflammation, the result of extension of disease, will be found in Mr. Swan's chapter upon ulceration of nerves. In the first case, that of William Sharpe,³ he suffered such violent pain in the thigh and leg as far as the ankle, that he wished to have the limb amputated. The ulcer was upon the tibia, and the only nerve ulcerated was the dorsal branch of the peroneal; yet the pain was by no means confined to the parts upon which this nerve is distributed. All the other nerves of the leg were implicated: "the sciatic nerve was very much enlarged, but many of its branches more so in proportion," and "varicose veins were observed in several parts" of it. "Some of the nerves were unusually soft, and easily torn." "The branch of the anterior crural nerve, accompanying the saphena vein, was somewhat enlarged; about an inch and a half above the ulcer it was still larger, and it was nearly surrounded by the ulcer, and at the upper part of this was firmly united to the adjacent parts for an inch and a half." "The peroneal nerve was very much enlarged, and the anterior tibial and dorsal branch of the peroneal were nearly twice the size they are in a healthy limb." "The anterior tibial nerve was enlarged, and proceeded firmly united all the way to surrounding parts." "The long cutaneous branch of the peroneal nerve was very much enlarged." "The posterior tibial, at the upper part, was larger than natural, but towards the bottom of the leg was still larger, and continued so until it had got beyond the inner ankle." Those who consider the extent to which the nerves of this limb were inflamed, will cease to wonder that the patient's sufferings were so excruciating as to make him wish to have the limb amputated, before his surgeon was disposed to accede to his request; and the case is an admirable illustration of the extent to which inflammation occasionally extends in the course of the nerves, both upwards

³ On the Diseases of Nerves, p. 69.

towards the sensorium, as well as in the direction of their remote distribution.

In the second case,⁴ one of fungous ulcer in the lower part, and chiefly on the outside of the left leg, the patient had suffered excruciating pain, which darted down to each side of the ankle and top of the foot. The pain she experienced was continuous, but became most violent in the night, and generally about the time she was going to sleep. Mr. Swan introduces this case by stating, that "although the nerves were not exactly ulcerated, yet they were so connected with diseased parts, and many branches from them were distributed in such a manner to the fungus, as to occasion the same symptoms." This is a virtual admission that the phenomena were those of inflammation, not the result of ulceration. The symptoms were common to both cases, and must have arisen from a cause common to both. But ulceration existed only in one, inflammation in both; and it is impossible, therefore, not to infer, that the pain this woman experienced was the consequence of inflammation, not of ulceration. Accordingly, upon dissection of the amputated limb, "the peroneal nerve was found much larger in the lower part of the ham than it was higher up. Its long cutaneous branch was blended with the posterior part of the fungus, and was then so much enlarged and confused as not to appear like a nerve; but beyond, the fungus had again its natural appearance. The anterior tibial, near the fungus, was "covered by a firm vascular membrane, from which it could hardly be separated. This was the case most of the way through the fungus, after which it had a more natural appearance." "The dorsal branch of the peroneal nerve could, in the same manner, be traced to the fungus, when it exhibited nearly the same appearances as the anterior tibial. Just at the beginning of the fungus it gave off to its base many filaments, which were very much enlarged."

A third case is related by Mr. Swan,⁵ of a large ulcer on the left leg, with exuberant granulations which bled pro-

⁴ On the Diseases of Nerves, p. 73.

⁵ Page 77.

fusely, attended with excruciating pain which hardly ever allowed the patient to rest; and it was so bad at night as to oblige him to get out of bed. The pain came on with violent stabs, like spasms, which extended up the outside of the leg to the ham, and from thence to the back; and in these paroxysms the limb would frequently be moved involuntarily. The pain was almost entirely confined to the peroneal nerve, for when pressed in the ham, it produced or aggravated the violent pain. A portion of the peroneal nerve, near the outer hamstring, was removed by excision, when an artery bled freely, but ceased without the application of a ligature. "The pain in the ulcer ceased, and he had no feeling when the upper part of the foot was touched." But the day after the operation there was a pain in the wound, and there was a perfect sensation in the upper part of the foot. The discharge of pus and blood ceased after the operation; "he never had any of the spasms in the limb, or any of the violent pain which followed the course of the sciatic nerve, and caused so much suffering;" "but he still at times suffered pain from the connexion of the saphenus nerve with the ulcer." In about six weeks after, amputation became necessary in consequence of the extent of caries of the tibia, attended with diarrhœa and night sweats, under which his health appeared to decline. Upon examination of the limb, it appeared that the saphenus nerve "was very much enlarged, and was connected with the ulcer. The sciatic nerve was enlarged." "The peroneal nerve was also enlarged, and at the place where it had been divided was much thickened; and one new branch went from this part to the anterior tibial nerve. New branches went from the same portion of the divided nerve to the dorsal branch and the surrounding parts. Both the anterior tibial nerve and the dorsal branch were larger than in their natural state." The state of the nerves thus discovered upon dissection explains satisfactorily the symptoms. Until the communication with the sciatic nerve was cut off by the division and excision of a portion of the peroneal, irritation, perhaps inflammation, crept upwards along that nerve, so as to affect even its

motor branches ; but, upon its separation from the source of irritation, the evil consequences were intercepted. On the day succeeding the operation there was no pain in the ulcer, but there was "a little in the wound:" this continued on the following day ; and on the third day after the excision of the nerve the ulcer is reported to have been again painful. This pain could hardly have resulted from "the connexion of the saphenus nerve with the ulcer," since that nerve must have been equally affected on the day of the operation, as on the two succeeding days ; it was probably the result of inflammation having occurred at the upper extremity of the divided nerve, for the wound had been exceedingly painful for a whole fortnight before the amputation of the limb. On pressing the part where the nerve was divided, "the patient said he felt it quite down his leg." But as the continuity of the nerve was destroyed, the limb, as far as that nerve was concerned, was as if it had not existed ; and the pain, which returned in the ulcer, was probably to be referred to the same principle as that in an amputated limb, in which Haller states that an individual can hardly divest his mind of the idea that he is bending the joints of the separated member.

The question as to the existence of new branches, and of their influence, in such case, in conveying the nervous influence, rendered defective by the operation of dividing the peroneal nerve, I leave to those more versed in these matters than myself. Mr. Swan himself is not altogether confident in his own opinions upon the point, and his account, therefore, of such new nerves requires confirmation. Is it not possible, or even probable, that these supposed new branches may have been some of those minute filaments which, from their extreme tenuity in a natural state, escape the observation of the anatomist, but partaking of the inflammation of the trunks with which they communicate, may have become indurated and enlarged, and consequently capable of being traced ? just as in some parts and surfaces of the body, there are vessels so small in their natural condition as not to admit the red particles of the blood, and are therefore imperceptible ;

and yet they become abundantly obvious when, from simple congestion, or from inflammation, red blood is forced into and distends them. This is, indeed, but a conjecture, or at best an argument from analogy; but no one has yet discovered the ultimate fibril of a nerve, or even traced it, (excepting perhaps in the optic nerve,) to that point where, divesting itself of its neurilematous investiture, it begins to dilate, as some suppose, into a pulpy expansion to become the seat of sensation.

There is in the last edition of Sir Benjamin Brodie's valuable work "On the Diseases of the Joints"⁶ an interesting case, in which the distention, or stretching, of some filaments of lumbar nerves by subjacent glands is supposed to have modified the symptoms of a diseased hip-joint. "One evening after the application of leeches he had a paroxysm of violent pain, attended with spasmodic action of the muscles of the thigh. The pain during this attack was so excruciating, that, to use his own expression, 'he wished for immediate death.' From this time, however, he was never wholly free from pain, and he was also liable to repeated attacks of more intense suffering, attended with violent spasms of the muscles of the thigh. The slightest motion of the limb induced one of these attacks of spasm, during which the thigh was jerked in a most remarkable manner." It is scarcely necessary, after what I have already advanced, to state that these are precisely the phenomena which arise from inflammation of nerves. The symptoms are to be referred principally to those branches of the anterior crural nerve, which supply the great muscles of the thigh; for the thigh was apparently affected to the exclusion of the leg. There had been inflammation with "a collection of thin pus amongst the muscles on the anterior part of the thigh, below the hip-joint, but communicating with it. The tumour, thus formed, was of the size of a large orange, and being situated under the femoral artery, the latter was thereby raised out of its natural situation. There were two enlarged lymphatic glands, each of the size of a walnut, immediately below the crural arch on the fore part of the joint, and these lay in contact with, and immedi-

⁶ Page 224.

ately behind two branches of the lumbar nerves, so as to keep the latter upon the stretch, like the strings passing over the bridge of a violin. This last-mentioned circumstance seemed to afford a reasonable explanation of the spasmodic affection to which the patient had been liable, and which, probably, had become relieved in consequence of some degree of diminution in the size of the glands after the escape of the abscess from the joint."

Several considerations lead me to doubt the accuracy of this explanation, which is not given with any great confidence by the author himself. He offers it only as probable and plausible, not as conclusively established. It may be objected, first, that it is no unfrequent occurrence for the whole of the glands, to which allusion has been made, to be immensely enlarged and of a stony hardness, from cancerous ulceration of the os uteri and upper part of the vagina. They may be seen as well as felt, and often implicate the whole chain of lumbar glands also; and yet it has never chanced to me in any one of these cases, which my connexion with the Middlesex Hospital has given me repeated opportunities of examining, to witness similar extraordinary jerkings of the limb, though I have not unfrequently found the cutaneous branches of the upper part of the thigh implicated, so as to produce pains of neuralgic character; and not uncommonly I have observed, in similar cases, considerable numbness with imperfect movement of the thigh. 2ndly, If the pain and convulsive movements arose from any influence upon these nerves, it must have been because they constituted part of those bundles which go to the formation of the anterior crural nerve, all the branches of which should have been similarly influenced. The knee would have been affected, as it is in hip-disease. 3rdly, The nerves which passed over the glands, situated near the joint, were more probably mere cutaneous branches, and neuralgia without muscular spasm would have occurred, if these had partaken of the inflammatory disease of the neighbourhood; or, if simply stretched by elevation, diminished sensibility would have been the more probable result. 4thly, There was much suppurative inflammation, of an unhealthy

character, amongst the muscles which the branches of the anterior crural nerve supply with nervous energy; these, surrounded by parts undergoing inflammation, would probably partake of that morbid condition; and this is rendered more probable by the observations of Sir Charles Bell and Mr. Swan, both of whom have seen nerves contiguous to disease of joints or other organs becoming inflamed, and producing the symptoms and changes of texture consequent upon inflammation. "It was but the other evening that a gentleman complained to me of a pain and numbness of the back of the thumb and fore-finger; this I found referable to a disease of the elbow-joint, and an affection of the muscular spiral nerve. I visited a woman with a disease of the womb, who complained of an unusual pain and frequent spasms of the leg. I imagined that the disease had involved the sacro-ischiatic nerve, and *found it so on dissection.*"⁷ "The nerves contiguous to a diseased joint are apt to become enlarged. In one case of scrofulous disease of the elbow-joint much pain had been experienced. The ulnar nerve was very much thickened and enlarged as it passed behind the internal condyle of the arm-bone; the median nerve was also enlarged but not in the same degree."⁸ Since, then, in Sir Benjamin Brodie's case there was disease of the joint, around which nerves are apt to become inflamed; since the motor filaments must have been surrounded in their course by the collection of thin pus amongst the muscles affected; and since the symptoms were those of inflamed nerve, I think it more probable, upon the whole, that the pain and jerkings of the limb were rather from inflammation, than simple stretching; and it appears to me a valuable illustration of the extension of an inflammatory affection from surrounding parts to a nerve in their vicinity.

But this view of the case by no means diminishes its interest. It equally "shews to what extent the symptoms may be modified and aggravated by an accidental circumstance;" the consequences, whether the result of stretching or of inflammation, being any thing but trivial.

⁷ Operative Surgery, vol. ii. p. 330.

⁸ Swan, p. 65.

Another curious instance of the extension of inflammation from contiguous parts to a particular nerve will be found in the Transactions of the Medical Society of London, by the late Mr. Norris, surgeon to the Charter-house,—the subject of which was his apology, as it must be mine, for giving the most characteristic details in Latin, rather than in the vernacular tongue. The nerve, which appears to have been affected, was the internal pudic, and the symptoms which presented themselves those of ungovernable satyriasis. This vigorous gentleman, *sixty years of age*, “nunquam meminit se in venerem propensioem fuisse, nedum insana et insatiabili libidine permotum ante hos duos menses, quando se diro hoc et teterrimo correptum esse morbo sentit; cujus vis tanta est et tam effrænata ut expleri nequeat; et ad coitum cum uxore se singula nocte quindecies saltem, imo vicies nonnunquam impellat.” As might be expected, the evils of such a state were not confined to the patient himself: Mr. Norris, therefore, begged to be allowed “cum uxore colloqui. Imo inquit, id ipsa summopere vult quippe admodum invalida tuique indiga consilii. Eo visum et reperio feminam matronali pudicitia et gravitate decoram quæ omnia dudum a marito narrata amplissimo testimonio comprobavit, adjecitque se propter noctes continuo insomnes et inquietas multa lassitudine, et propter vim sibi toties oblatam pudenda sibi tumore et dolore affligi. Cum de constanti in coitu immissione seminis rogarem, fidem fecit, virum omnia vere dixisse; nunquam enim aliter ab illo rem actam fuisse. Quibus verbis ei facilius et libentius credidi quod mulierem bis nuptam, et ex utroque marito bis matrem experientia satis hæc edocuerat.”⁹

The cause of these extraordinary symptoms was a tumour from a blow upon the perineum, which, increasing and at length becoming softer, was opened by incision, and gave vent to an abundant discharge of a glutinous and sanious character, a short time after which the symptoms vanished, and the wound healed kindly. This is, indeed, a rare sequence of inflammation and abscess of the perineum; and the peculiar results appear to me to be explicable upon no other supposi-

⁹ Trans. of the Med. Soc. of London, vol. i. part i. p. 174.

tion, than that the internal pudic nerve, which ministers to an office of great animal gratification, and which supplies certain erector muscles and other contiguous sensitive parts, had become implicated in the surrounding inflammation, and produced, in the language of modern physiologists and pathologists, an exaltation or exaggeration of function.

Some, perhaps, may fancy that in these instances the mere acrid products of inflammation, like certain chemical agents, may have irritated the nerve by contact; as in the numerous experiments with concentrated mineral acids, or, according to Haller, as in the mere application of a cold sponge. An observation, however, of Bichat, upon this point, may be taken as at least an approximation to evidence that this is not sufficient. After stating that sensibility depends rather upon the medullary fibre than upon the neurilema, whose office it is to protect the medullary matter, he adds, "hence it is that simple contact, without compression, is very little painful; and that a nerve may almost with impunity be bathed in a purulent ichorous fluid, and even in the sanies of cancer."

Amongst other causes of inflammation of a nerve, *pressure* ought not to be excluded. Numerous instances are upon record in which such connexion has been traced; and hence many, who have discovered tumours situated in the course of nerves attended with suffering, have adopted the conclusion, that compression of a healthy nerve will occasion pain. The recorded cases, however, when minutely examined, do not appear to warrant this inference; for in the majority of such instances, subsequent dissection has shown even extensive disorganization of the nerve itself. Of this Morgagni¹ has related two very interesting instances. In one, that of a man fifty years of age, an aneurism first made its appearance in the groin, and, increasing gradually, became attended with considerable pain and œdema. During the last month, the pain had been excruciating, not only in the tumour, but often below the inner ankle, the rest of the foot having lost all sense and motion. It was found, on examining the body, that the aneurism, extending to the great sciatic nerve, had so eroded

¹ Epist. Anat. Med. I. Art. 11.

it, that very few (*via paucæ*) fibres remained to connect the upper with the lower part. Morgagni gives an accurate explanation of the symptoms, founded on dissection. After the distended vessel, he says, had given way, and formed a spurious aneurism, the clots pressing upon the veins impeded the return of blood, and œdema was the consequence. These also forcibly separating the muscular fibres and their nervous filaments from each other, occasioned a pain which was, however, much more bearable than that which subsequently occurred when the nerve *began* to be eroded. At length, when the nerve which communicated the faculties of sense and motion to the foot was almost entirely eroded, (*exesus*,) both these faculties were lost, excepting under the inner ankle, which part derives its nerves not only from the posterior crural, but also from that branch of the anterior crural nerve which accompanies the saphena vein. Hence, Morgagni adds, an aneurism may destroy life not only by bursting, but also by the agonizing sufferings (*per acerbissimos cruciatus*) which it may induce.²

The other case was one of popliteal aneurism, of the size at least of a small melon, which produced most excruciating pain in the limb. The patient died of sphacelus, followed by hæmorrhage. Along the whole trunk of the aneurism was a cavity full of grumous blood and matter, the nerve and vein being completely eroded, as were also the condyles of the femur and the head of the fibula.

A similar instance occurred to Guattani of popliteal aneurism attended with violent pain, in which the nerve had been much changed in its course and character, and was probably glued to the surface of the tumour by an inflammatory process; and in the valuable paper upon malignant tumours by Mr. Travers, is a case of tumour, situated in the ham, and producing very severe suffering, which the author was disposed to ascribe to "the obvious circumstance of pressure;" but the details of which case force conviction, the grounds of which I shall hereafter state, upon my mind that the nerves had become inflamed.

² Ep. I. Art. 55.

Occasionally the symptoms mark the existence of inflammation of nerves; and yet we can trace none of the causes, which I have enumerated, or any other, to account for its occurrence; and we are then driven to the conclusion that it is an *idiopathic disease*. M. Descot represents this as an extremely rare occurrence, but still its existence has been very satisfactorily ascertained. The more superficial nerves of the extremities being the most common seat of the disease would seem to afford countenance to the opinion, that the principal cause is exposure to cold. Hence it is by no means uncommon in the sciatic nerve, in which, in the opinion of M. Descot, a great many cases of ischias have their seat.³

In the absence of all evidence of the existence of any local cause, it may be safely inferred that one of the cases related by Mr. Earle was of this kind. This patient laboured under the symptoms of inflamed ulnar nerve, the whole of which, in its course from the elbow downwards, was morbidly sensible when touched: "the mere drawing on of a glove would sometimes cause so much pain as to make her scream and fall to the ground." The pain at times occurred spontaneously, without any apparent exciting cause. The integuments on the inside of the fore-arm near the elbow were hotter and fuller than natural. The symptoms were removed by excision of a portion, equal to rather more than an inch, of the nerve, when it was found upon examination "that the neurilema covering the nerve appeared thicker and firmer than natural." These appearances were incontestably the consequence of inflammation, no cause for which could be ascertained; for "she was unable to account for the origin of the complaint, and said that it had been gradually increasing for some months."

In the instance, also, quoted by Dr. Cooke from a manuscript communication to him by Sir Charles Bell, inflamma-

³ " Dans beaucoup de cas de sciatique, je crois que le nerf sciatique est le siège de la maladie; la douleur suit, en général, si exactement le trajet du nerf, et les parties voisines sont tellement libres de toute apparence pathologique, que je crois que le nerf seul est le siège de la douleur; et l'affection, ce me semble, doit naître d'une action inflammatoire dans le neurilème, laquelle se termine souvent par l'épanchement d'un fluide séreux.—Descot, p. 200.

tion had occurred spontaneously in the ulnar and fibular nerves, and the pain, which was of a most agonizing kind, had confined the patient for two years, and “had quite subdued a powerful frame.” The existence of inflammation was proved by the tender state of these nerves which, throughout their course, were acutely sensible to the slightest pressure, by the periodical and alternate accessions of pain, and by the effect of remedies; for the disease yielded to measures, the principal of which consisted in repeated purging and the application of leeches along the course of the nerves.

Tumours occasionally form within the substance of nerves, and produce, generally, well-marked symptoms of excitement. These tumours vary in situation, in size, in form, and in texture. They may exist in nerves in the interior of the cavities of the body, or in those of the extremities—the latter, however, being by far the most frequent—and in both they occasion the phenomena of excitement; convulsive movement, if a motor nerve; severe neuralgia, if a nerve of sensation; the combination of the two if a symmetrical or compound nerve, before it has exhausted its muscular filaments. A striking example of the effect of such tumour, imbedded in an internal and simple motor nerve, will be found in a case which occurred to M. Berard, aîné. The phrenic nerve of the right side appeared interrupted by a tubercle as large as a pea, scirrhous and blackish, and had produced asthma,¹—obviously implying a convulsive action of the diaphragm. Instances of similar tumours in the nerves of the extremities are by no means uncommon; and upon this branch of his subject M. Descot has shown great industry, research, and judgment, and has, at the same time, done ample justice to the British records of medicine and of surgery, from which he has derived a large proportion of his illustrations.

These tumours commonly form upon sentient filaments of cutaneous nerves, before they terminate in the cutaneous tissue for the purpose of conveying impressions from the surface; and they are, consequently, generally found in the upper and lower

¹ Journ. Hebdom. tome ii. p. 73.—See also Descot, p. 257.

extremities. M. Marjolin, however, communicated a case to Descot, in which they appeared to exist very near to the sentient extremities of the scrotal nerves. There were in the cellular tissue of the scrotum "many small, lenticular, smooth, hard, and insulated bodies, compression of which between the fingers produced pains like those which the patient habitually experienced."² A trifling incision upon each enabled M. Marjolin to remove them all; they weighed a few grains each, and were of a fibro-cartilaginous texture. The sufferings of the patient ceased altogether from the period of the operation.

They are sometimes very small, as in the disease so accurately described by Mr. Wood under the denomination of "painful subcutaneous tubercle," of which he has recorded five instances occurring within his observation, and others communicated to him by his professional friends, amounting altogether to eight cases, all of which yielded to extirpation of the tumour.³ The disease, however, had been noticed by others before his time, and amongst them by Cheselden,⁴ Camper,⁵ Morgagni,⁶ Portal,⁷ Bissett,⁸ and Pearson.⁹

Mr. Wood has offered no explanation of the pathological nature of this disease, but Mr. Windsor has supplied the deficiency by tracing the filament of a nerve into the substance of the tubercle.¹ Mr. John Pearson also saw at the upper extremity of a slough, which he had produced by an escharotic applied for the purpose of extirpating the tubercle, the ragged extremity of a nerve, as well as the saphena vein; thus proving incontestably that the nerve is, at least, essentially implicated, and is probably the matrix of the tumour.

Of these small tumours, generally found in cutaneous branches, the excruciating pains of neuralgia are the com-

² "Douleurs vives, lancinantes, intermittentes.—Descot, op. cit, p. 245.

³ Ed. Med. and Phys. Journ. vol. viii.

⁴ Anatomy of Human Body, p. 136.

⁵ Dem. Anat. Path. L. i. p. 11.

⁶ Ep. Lib. art. 19.

⁷ Anat. Méd. vol. iv. p. 246.

⁸ Mem. of Med. Soc. of Lond. vol. iii. p. 58.

⁹ Med. Facts and Obs. vol. vi. p. 96.

¹ Edin. Med. and Phys. Journ. vol. xvii, p. 262.

mon, if not the invariable consequence.² In some, with this violent pain have been combined muscular spasms of the limb, and even sometimes general epileptic convulsions; but I know of no instance in which paralysis was observed.

Tumours of greater magnitude imbedded in the substance of nerves are less frequent than the smaller, and are to be found, commonly, in the larger and deeper-seated trunks. These, like the smaller tubercles, are generally attended with neuralgic affections in the distribution of the diseased nerve. In some of the cases there is, also, muscular spasm combined with the intense suffering, but upon other occasions it is absent; and sometimes the muscles are even paralysed, or at least have defective power. Cheselden mentions a tumour of this kind, but his history is imperfect. It was situated in the centre of the cubital nerve, and occasioned a great numbness in all the parts to which that nerve leads, and excessive pain upon the least touch or motion. The pain ceased with the operation, but the numbness increased a little. The operation here mentioned, as explained by the engraving, consisted in the removal of the tumour, together with a portion of the nerve at each of its extremities.³ The filaments of the nerve ran over the surface of the tumour, and were separated from each other. In this case the ordinary function of the nerve was essentially impaired, the few undiseased filaments upon the surface bestowing a small proportion of sensibility only on the parts supplied by the nerve, the total division and removal of which could only "increase the numbness a little." The pain, therefore, produced by touch or motion was probably produced in the diseased portion, but, as in stumps, referred to a distant part; just as in Mr. Earle's case, wherein he supposed the axillary plexus of nerves to have been lacerated or crushed, as they pass under the clavicle, the violent pain referred to the extremities of his fingers, which was occasionally produced in the "useless and paralysed limb" by any attempt to move it,

² In the case related by Morgagni from Valsalva, the pains were so excruciating that the patient, an unmarried female, would have cut off her own foot had she not been prevented by her own domestics.

³ Cheselden's *Anatomy*, Tab. xxviii. p. 256.

and at times when perfectly quiet, was probably "excited where the nerves were injured under the clavicle, and the percipient mind referred it to the extremities, as is frequently the case after amputation."⁴

Sir Everard Home, also, has detailed two instances of this painful disease. Both were attended with excessive sensibility in the tumour, pressure upon which produced not only great suffering in the part compressed, but pains also in the distribution of the diseased nerves. The first of these two cases was cured by excision of the tumour, together with an adjacent portion of healthy nerve; the other, in which the operator contented himself with disengaging the tumour from the interior of the nerve, terminated unfavourably. "*In consequence of having been inflamed*, the cavity was lined with coagulable lymph, and almost filled with coagulated blood, as suppuration had not completely taken place." That, however, there was more than a mere tendency to the formation of matter, is to be inferred from the general practical conclusion, which Sir Everard himself draws from the two cases, that "the taking away three inches of a nerve is productive of less violent effects than are occasioned *by inflammation and suppuration* in the substance of a nerve for an equal extent."⁵

In the operative surgery of Sir Charles Bell⁶ is related another interesting example of the same disease from mechanical injury of the popliteal nerve. This man appears to have died, worn out by the mere severity of pain. The peroneal nerve had escaped both the effect of the injury and the contamination of disease; its function was therefore perfect, excepting when from change of posture, as in sitting, it became subject to compression from the contiguous tumour. Then, the parts supplied by the latter nerve lost their sensibility; and the case possesses an extraordinary interest, as presenting us with a striking illustration of the difference between morbid excitement in a diseased nerve, and paralysis

⁴ Med. Chir. Tr. vol. vii. p. 176.

⁵ Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, vol. ii. p. 163.

⁶ Vol. ii. p. 330.

from pressure upon one that is healthy. The tumour in the popliteal nerve produced such agonizing pains in the parts upon which that nerve is distributed, as to destroy the patient; but when, in bending the leg, the peroneal nerve, which was *undiseased*, became compressed between the tumour upon one side, and the inner hamstring upon the other, between the tendinous fascia immediately above, and the condyle of the femur below, the parts supplied by this nerve were immediately deprived of their nervous energy.

A gentleman, whose leg had been amputated in 1819, to free him from an exquisitely painful tumour of the thigh, consulted Mr. Lawrence in 1828, on account of a tumour in the fore-arm, as large as a walnut, situated over the course of the ulnar nerve, and causing severe pain, with indescribable sensations, like electric shocks, upwards and downwards in the direction of that nerve. The disease was removed in February 1829. "It was situated between the flexor carpi ulnaris and the bone, and *the nerve adhered so closely to it*, that a portion was removed with it. The part healed favourably, and remains well."⁷ A similar tumour afterwards formed in the flesh of his stump; this was as large as a goose's egg, and produced most severe shooting pains in the part, with repeated recurrence of electric dartings from the stump into the body. The growth appeared to be prolonged to the tuber ischii, and was removed up to the bone. Mr. Lawrence has given no other account of these tumours, than that they were not malignant, although they were originally suspected to be so. But from their situation, character, and symptoms, it appears difficult to dissociate them from the tumours, I have been noticing, either imbedded in, or intimately connected with, if not morbid growths of, the nerves affected. The resemblance between this case and that related by Sir E. Home is most striking, the only difference being in the nerve affected. In the former, the ulnar nerve was affected; in the latter, the musculo-cutaneous. Both were attended with severe darting pains in the course of the nerve: in the former, the nerve adhered so closely to the tumour, that in the removal of the latter a por-

⁷ Med. Chir. Trans. vol. xvii. p. 33. The paper was read Nov. 8, 1831.

tion of the nerve was removed with it; "in the latter, the tumour terminated at its upper and lower ends in a strong white cord, which proved to be the musculo-cutaneous nerve:" this led to the removal of a portion of the nerve. There is also another curious analogy to be observed between the case of Mr. Lawrence and the second of Sir Everard Home: this consisted in the proneness to the formation of similar tumours (*névromes*) in other nerves. They are commonly imbedded in the substance of the nerve, but the direction of their growth may be influenced by external causes. If they grow towards the interior, fibres of the nerve will be found upon the surface of the tumour, as in Cheselden's case; if meeting with little resistance in the growth outwards, the nerve will appear behind, but attached to, the tumour, as in Mr. Lawrence's case, and in one of those described by Sir Everard Home; but more commonly they are in the centre of the nerve, and a few scattered nervous fibrils may generally be traced all around them. They are said to be encysted; and from the facility with which, in Sir Everard Home's case, the tumour was detached by the finger from the thin investing membrane, probably composed of neurilema, the opinion appears not without foundation. M. Andral believes the larger tumours to be seated within the enveloping membranes of the nerves; sometimes to be a mere deposit betwixt the fibres of the nerves, which are extended over the tumour like ribands; whilst others are consisting of many cysts, containing a jelly-like fluid; and others again of a single and larger cyst, of a fibrous or cartilaginous texture, containing matters of different character.⁸ The smaller sub-cutaneous tubercles he pronounces not to be formed in the substance of the nerve, though some of the nervous filaments may be attached to them; and in this opinion he is supported by Dupuytren and James. I have, however, upon the whole, more confidence in the perspicuous statement of Camper, who had seen many cases in women, with whom all are agreed that it is more common than in the opposite sex, and who adds, "*in viris plus semel ea (in nervis tubercula parva dura) vidi: albicant intus, cartilagineæ du-*

⁸ Précis. d'Anatomie Pathologique, vol. ii. p. 838.

ritiæ sunt renidentia et *intra nervorum tunicas* sedem habent ;” and this confidence is much increased by the simple annunciation, by Mr. Windsor, of the facts, that in the course of the operation for the removal of such tumour, “a filament of a nerve was observed going to the part,” the removal of which was immediately followed by numbness; and that “the little tumour, along with *the nerve which penetrated it*,” was preserved and shown to his friends Dr. Hull and Mr. Wilford.⁹

The *size* of the subcutaneous tubercle varies from that of a pin’s head up to that of a horse-bean, or almond deprived of its shell, and has been compared to a pin’s head, a split pea, a flattened pea, a coffee-bean, a horse-bean, and an almond. The larger tumours differ in bulk from that of a hazel nut up to that of a small melon, which was the size of one removed with impunity, and indeed success, by M. Dubois.¹

The smaller tumours are commonly whitish and pearly, and, according to Andral, fibro-cellular, or fibro-cartilaginous. In *texture*, they are described by the majority of writers as very hard like cartilage,² containing, in some instances, gritty or earthy particles;³ by some French writers, as resembling in character true carcinomatous scirrhus,⁴ and as having such an intimate alliance with that disease, as to lead M. Bégin, in his article Cancer, in the “Dictionnaire de Médecine, et Chirurgie Pratiques,” to designate the disease “cancer des nerfs.” But this is an objectionable application of the term cancer; for although it has been asserted that the tumour has assumed the character of a “*dégénération squirrheuse*,” yet no instance, as far as I know, has been seen in which it went on to the production of cancerous ulceration. The larger tumours are rarely so firm in structure, or so distinctly fibrous in texture. These often consist of numerous cysts, sometimes containing materials of varied degrees of consistence; in some instances like transparent jelly⁵—in others, encephaloid⁶—in others, again, of a syrup-like consistence,

⁹ Edin, Med. and Phys. Journ. vol. xvii.

¹ Alexandre, De tumoribus nervorum.

² Cheselden, Camper, Wood, Hall, Swan, Descot.

⁴ Delpech, Dupuytren, Andral, Berard.

⁶ Dupuytren, Descot.

³ Windsor.

⁵ Cheselden.

interspersed with fibrous striæ.⁷ But the most accurate description of these larger tumours is given by Sir Everard Home, who, speaking of the first which he extirpated, says, "it had the appearance of serpentine nervous fibres, running in the course of the nerve; these were separated from each other, and the interstices filled up with the substance of the tumour; but that part of the tumour which was exterior to these fibres had something of a radiated structure."⁸ The second tumour, which he removed from its matrix in the centre of the nerve, was of a yellowish white colour; "when cut through, it was found to consist of a whitish firm substance, in the centre of which there was a very obscure fibrous texture, and towards the outer surface the texture was indistinctly radiated." A second tumour, much smaller than the one removed, in the same subject, was exactly similar to that from the arm of the first of these cases, except that the spiral direction of the nervous fibres⁹ in the centre were readily distinguished by the naked eye; "in other respects it was exactly the same. The want of distinctness in those of the larger tumour may therefore be reasonably supposed to be the effect of the increase of size, by which they were rendered obscure."¹ Another great master of description has given us an account of the structure of a tumour which he removed:—"It was of firm texture, but not so hard as scirrhus; the swelling was covered with a thin white capsule, and was homogeneous; in compactness, toughness, and colour, it approached to the character of scirrhus:"² and this account, in combination with the symptoms including pain like electric shocks, and with the attachment of this tumour to the nerve, a portion of which it was necessary to remove together with the tumour, is calculated to remove all doubts as to its seat and nature, and identifies it with the disease, the pathological character of which I have been noticing.

Whether these tumours are to be considered as inflammatory products has not been determined, and is of little

⁷ Descot.

⁸ Med. and Chir. Trans. vol. ii. p. 156.

⁹ "Des circonvolutions et des contours vermiculaires."—Descot, p. 248.

¹ Home, op. cit. 159—161.

² Lawrence, in Med. Chir. Trans., vol. vii. p. 34.

moment. If not the result of inflammatory, at least they are the consequence of morbidly increased action of the arteries of supply. That, however, they are occasionally attended with inflammation of the contiguous portion of the nerve is matter of observation, the nerve having in some instances been found of three times its average dimensions; and in the case operated upon by Sir E. Home, the vessel of the interior of the nerve, from its enlargement, bled so profusely, as to require the application of a ligature to restrain the flow of blood.

Another question suggests itself upon this subject, which it may be equally difficult to answer;—this relates to the precise mode in which these tumours occasion the sufferings, which, as far as I have been able to collect, are their invariable result. M. Descot is of opinion that they act by keeping up a state of chronic inflammation of the nerve. No decisive evidence, however, has been adduced of this; it is stated merely as a matter of suspicion or belief, but without investigation and without proof. Still, it is far from improbable, though they may act also as mechanical irritants; and to their influence, as such, their hard texture, often described as gritty or gristly, or like grains of sand or cartilage blunting a knife with which the attempt is made to cut through them, would naturally contribute; thus resembling, in their effect, the experiments of pathologists upon nerves with the point of a needle, a forceps, or a probe. Some, again, may think that they act by distention of the fibrils of the nerve; but that such is the effect of distention has not been at all satisfactorily proved, and appears to be in great measure negatived by the observations and experiments, to which I have before adverted.

But the decision of these points is of comparatively trifling moment. It is enough that these tumours, whether in the form of painful subcutaneous tubercle or of the larger tumours in the trunks of nerves, produce, in point of fact, the phenomena of an “exaltation of function” rather than those of paralysis; or if this be not universally true, the exceptions are so rare, that they may be said, according to the old gram-

matical axiom, to prove and establish, rather than to overturn, the general principle. "Exceptio probat regulam."

Such are the principal pathological conditions of a nerve upon which its excitement, productive of a morbid excess and irregular distribution of nervous energy, have been found most frequently to depend. But occasionally none of these causes can be traced, and pathologists are then driven to adopt the alternative conclusion, that the symptoms result from mere *functional derangement*. This inference, however, involves a negative proposition, which, like other negatives, it may be difficult or impossible to prove, and which, in some instances, subsequent dissection has shown to be an assumption contrary to fact. An exciting cause cognizable to the senses has been sometimes detected after death, (where there had been no previous suspicion of its existence,) either at the very roots of the nerves in the brain, or in the spinal marrow, or somewhere in the course of the nerve, or in the part itself which is the seat of the painful affection. An instructive example has been recorded by Mr. Serres,³ of the most severe neuralgia arising from disease of *the root* of the fifth pair. It was examined in the presence of some of the most enlightened of the profession in Paris; but as it has been quoted at large by almost all subsequent writers upon this subject, it is unnecessary to give the details.⁴ In the case of one of the brightest ornaments of our profession, the late Dr. Pemberton, no suspicion, I believe, was entertained during his life, or at least until a very advanced period of his malady, that the tic douloureux under which he laboured so long and so severely, as to make him an object of commiseration to all his friends, was more than neuralgia,—a mere functional derangement, as distinguished from neuritis or other structural diseases; yet after death, in the head, and consequently at the very origin of the nerves, there was found a spiculum of bone, which had proved a source of mechanical irritation, analogous in its effect to the successive and frequent excitement of a nerve by a needle or forceps; the movement of the brain in the alternate

³ Archives de Médecine, vol. v.

⁴ Descot, Swan, Bell, Andral, Béjin.

actions of respiration bringing, as it were, the nerve to the pointed instrument, instead of the experimental physiologist bringing his instrument of torture to the nerve. In some of the instances of *tic douloureux* related by Sir Henry Hallford, the nerves, before their exit from the cranium, were incased in canals undergoing inflammatory action, the vessels being in that excited state which led to large deposits of osseous matter, so as to form, in the forcible language of the eloquent President of the College, a complete "rock-work."

In an instance of neuralgia of the posterior branch of the second cervical nerve, recorded in the admirable work of M. Ollivier, upon the Diseases of the Spinal Marrow, whilst paralysis had been produced by disease of the spine, the cause of the neuralgic affection was discovered after death in inflammation of that nerve *as it proceeded from the vertebral canal*; thus beautifully illustrating the important distinction between the effects of inflammation on the one hand, and of simple pressure upon the other.⁵

That the cause of neuralgia may exist at a considerable distance both from the ultimate distribution of the nerve affected and the seat of pain, yet remote from its origin either in the brain or spinal marrow, is also a point well ascertained, and of which endless examples might be produced. I shall, however, content myself with once more referring to the cases recorded by Mr. Earle, Sir Charles Bell, and Mr. Denmark, as affording ample and conclusive testimony of the fact.

But the cause may act upon the seat of pain itself. That cause may not, indeed, be appreciable to the unaided senses, and yet we may be justified in inferring it from the nature of the producing cause, as in the instance of neuralgia from the prick of a gooseberry thorn, related by Mr. Wardrop; or a piece of angular porcelain imbedded in the lip, recorded by Mr. Jeffries; or a sharp point of a nail by Mr. Swan; or decayed teeth, which become sharp, extraneous, and irritating bodies, as in the cases mentioned by Mr. Mitchell, Mr. Swan, and M. Descot.

Still it is but candid to admit, in the absence of all proof to

⁵ *Traité de la Moelle Epinière, et de ses maladies, tome i. p. 339.*

the contrary, that there have been cases, and those probably numerous, of most severe neuralgia and, perhaps, local convulsive movement, wherein no perceptible morbid change either of vascularity or of texture could be traced in any portion of the nerve, from which the parts affected derive their nervous energy. But the investigation of these cases of mere functional derangement presents to our view a field of inquiry so fertile in speculation and controversy, and so little promising in the prospect it affords of useful information; and, above all, it is so little connected with the province to which I have restricted myself, that it offers slight temptation to win me from the more immediate objects of my pursuit. I forbear, for these reasons, to do more than allude to this very extensive subject, and to tender my concession of a general principle, which, as must ever be the case with negative propositions, it may be more than difficult to prove; "for that sort of negative evidence in these cases is not quite satisfactory, because, in order to say that there was no state of disease in the nerves, it would be necessary to follow up the nervous filaments through their bony canals, and that would require a very long dissection, I believe that hardly any case has been examined in that way."⁶ Besides, even where the examination has been so conducted, it may be with a nerve as it is with the brain; "its minute and subtle structure opposes an obstacle, which must, on many occasions, be nearly insurmountable. Many changes may have taken place in so delicate an organ, unfitting it for the due and perfect performance of its functions, which changes may yet not be manifest to the senses. Morbid conditions of parts often exist without being discoverable by the eye or the touch of the practitioner. The change from healthy to diseased action, and still more from health to visible alteration of structure, is often by slow and imperceptible degrees."⁷

Symptoms and Consequences of Defective Nervous Energy.

Having now considered the general history of morbid ex-

⁶ Lawrence's Lectures on Surgery, Med. Gaz. vol. vi. p. 645.—On Neuralgia.

⁷ Clutterbuck on Fever p. 163.

citement of nerves, I am next to notice the evidences, the consequences, and the producing causes of defective nervous energy.

The direct results of this "*effect defective*" need not detain us long; they are the converse of those of excitement. If it exist in a nerve devoted to sensitive organs, the sensibility will be impaired; if in a motor nerve, paralysis of the muscles which it supplies will be the consequence; if in a compound or symmetrical nerve, which ministers both to motion and sensation, as in the extremities, local or partial paralysis will be the result; and this may exist in its various degrees, from mere imperfect motive power and impaired sensibility, up to complete paralysis of the muscles, and anæsthesia of the surface.

To this general law, however, there is an exception in those cases where paralysis has been the result of the destruction of the continuity of a nerve by an inflammatory process. The inflammation in these cases rarely continues in the part below the injured part; or if it does exist there, the communication with the sensorium being cut off, mechanical violence done to it produces no sensation; but inflammation is apt to linger in the upper portion of the divided nerve, and this may occasion pain referred to parts upon which it was originally distributed, although no nervous communication now remains.

The other collateral effects of defective nervous energy will require at least a brief consideration. One of the most common of these is *wasting of the muscles* of the part affected. This can scarcely be from any increase of absorption; it is too gradual for the operation of such a cause, and there is no proof of such increase: on the contrary, the puffy ankle often observed in paralytic patients, would seem to indicate that the lymphatics are impaired in their action, as well as the nerves of the limb. It is much more probable that this withering of the muscles arises from defective supply by the nutrient vessels in the last process of assimilation. It has been already seen, that in an excited state of nerve the arterial circulation is increased; so in cases of defective nervous energy, all the actions which depend upon nervous influence are diminished. The vessels of the capillary circulation, much under the influence of nerves, are enfeebled; the paralytic limb is

consequently defectively nourished, and the general results are well, though briefly, enumerated by Dr. Cooke, in his observation that "paralytic limbs often become more soft and flaccid than natural; they waste and shrink, and sometimes appear œdematous."

Another necessary consequence of defective arterial action is a *diminution of temperature* in the paralysed part. Upon this branch of the subject it has been already seen that Mr. Earle has entered much at large, and has deduced from the negative evidence which such cases afford, the general and positive principle, that "vital heat is the result of arterious action on the nerves," and this, "notwithstanding there is no apparent diminution in the circulation of the blood;"—a conclusion, however, with which the ingenious writer himself is not altogether satisfied, as a consideration of the experiments of Dr. Davy obliges him also to "consider the circulation of the blood as *one* source of animal temperature." I have already stated the grounds upon which I am disposed to dissent from Mr. Earle's views upon this subject, in the case of an excited condition of nerves; and the same reasons, *mutatis mutandis*, will apply to his explanation of the diminished temperature in parts deprived of nervous influence. The evolution of animal heat takes place in the capillary vessels, and is commonly in proportion to their activity; in paralysis, the wasting of the limb shows that these vessels have their function impaired; it is "soft, flaccid, wasted, and shrunk;" the caloric function "is proportionately impaired, and, as a general result, the limb is colder than the other."

This conclusion derives material confirmation from one of the experiments of Mr. Earle. He applied to the back of a paralytic hand a blister, which he "was obliged to repeat several times before it would act; at last, however, a vesication was produced. During the time that the blister was acting, there was no alteration in the thermometer placed immediately contiguous to the edge of the plaister; but on removing the bladder, and applying the bulb to the denuded cutis, a rise of three degrees took place. The blistered surface was not in the least sensible to any injuries, and healed very readily. The explanation of this is obvious, but seems

at variance with Mr. Earle's opinions. There is here no evidence of any direct impression upon the cutaneous nerves, so as to increase their energy: "*the blistered surface was not in the least sensible to any injuries*;" and yet there was an increase of temperature of three degrees. But the action of the capillaries *was* increased; the cuticle was separated by the inflammatory effusion from the subjacent texture; secretion, therefore, went on with energy. Those changes occurred under the influence of the blister, which usually accompany the alteration of colour in the transition from arterial to venous blood. Amongst the most important of these is the diminished capacity for caloric, in consequence of which "*vital heat*" is evolved, and the thermometrical temperature consequently increased.

The amount of this change of capacity has been somewhat variously estimated by different chemical philosophers. The specific heat, according to Crawford, of arterial blood, is greater than that of venous, in the proportion of 114·5 to 100; and according to three experiments out of four by Dr. Davy, who placed more reliance upon the results of the three which constitute the rule, than in the single exception, is in the relative proportion of ·913 to ·903. Since, then, in the experiment of Mr. Earle, there was no cognizable change in the state of the torpid nerves of the part, while the action of the capillaries was increased, it is natural to infer that the increase of temperature was owing to the augmented activity of the arterial circulation, of which there was ample evidence, and not of any increase of nervous influence, with respect to which, as there was no evidence, we may apply the logical axiom—"de non apparentibus et non existentibus eadem est ratio."

It appears to be a proof and consequence at once of the influence of the capillary arteries in regulating the temperature of the human body, a principle which has acquired almost universal belief, and of the extent also to which these vessels are subject to nervous influence, that if, in consequence of diminished energy of the nerves, the capillaries are weakened, *the power of resisting sudden*, though what to others, or to a sound limb in the same individual, would be

inconsiderable *alternations of temperature*, should be lost. That this is in reality the case has been fully ascertained, and has been well illustrated by Dr. Yelloly, whose patient, though insensible to the heat of boiling water, or the vesication which succeeded the inadvertent exposure of the limb to it, yet “on putting his hand, at the desire of a friend, into a pail of hot grains, into which his friend, to convince him that it was not too hot, had thrust his own hand, there was an extensive vesication produced.” His hands were never free from blisters, which he got by inadvertently putting them too near the fire; and he had met with several severe burns without being aware of it.”⁸ This remark has been also amply verified by Mr. Earle, in the interesting case of Thomas Anderson, who was “advised to place his hand in a tub of warm grains, having previously ascertained with his other arm that they were not too hot. He retained the arm in the pail for nearly half an hour, and, on withdrawing it, found the whole hand blistered in a most alarming manner; and at the extremities of his fingers, and underneath the nails, sloughs had formed.” It would be unnecessary, even if it were within the compass of my intention in this sketch of the principles of the pathology of nerves, to dwell upon the most important practical precept which these facts inculcate, of putting a patient upon his guard with respect to his paralytic extremities, which are so liable to serious consequences from such slight causes; the knee near to a fire may be vesicated, or even sphacelated, when the clothes, which cover it, have suffered nothing.

It has been shown that the results of defective nervous energy, when it amounts to a paralytic affection, are, in addition to the immediate effects, (want of nervous power and of sensibility,) a wasting of the limb the result of enfeebled action of the capillaries, diminished temperature from the same cause, and a want of power to resist sudden changes of heat. It now remains that I mention another consequence of long-continued paralysis—namely, the *withering of the nerves themselves*. Upon this point Dr. Cooke has the following

⁸ Med. Chir. Trans. vol. iii.

observation, part of which has been already quoted, for another purpose:—"Paralytic limbs often become more soft and flaccid than natural; they waste and shrink, and sometimes appear œdematous. Mr. C. Bell has observed, that in these cases the nerves themselves lose much of their substance."⁹ This is the "atrophie" of modern continental writers; a subject which has been somewhat elaborately considered by one of the greatest ornaments of the French pathological school—M. Andral. He describes it as a state "which we have rarely an opportunity of seeing, unless the part upon which the nerve is distributed has its nutritive powers, or other functions impaired;" and he illustrates this more especially by reference to the optic nerve, which he considers as the type of "atrophie" of all other nerves; quoting (with complete and deserved confidence in their accuracy) the observations and experiments of Soemmering and Magendie, to prove that atrophy of the optic nerve is the general result of the destruction of the eye; that it occurs more slowly in man than in other mammiferous animals, and more quickly in birds than in either; and he concludes with the expression of his belief that the rapidity with which atrophy of the optic nerve is produced, depends upon the greater energy of vision in the being deprived of it. He further remarks, that compression by tumours in their vicinity will also occasion atrophy of nerves, and mentions, in illustration of this, an instance in which the pneumogastric and phrenic nerves were subjected to compression, and consequent atrophy, from a schirrhous tumour, situated near or about them, and producing such *distress in breathing* as to have led to the suspicion of the existence of heart-disease.¹ Other instances are recorded, and amongst them, one of atrophy to the extent at last of the total disappearance of the optic nerve, from an osseous tumour occupying the situation of their decussation, which had entirely disappeared.² The olfactory nerves have

⁹ Cooke on Palsy, p. 8.

¹ Précis, &c. vol. ii. p. 876. Clin. Méd. Mal. de Poitrine, Liv. 2, §. 1. Obs. 21.

² M. Sanson, Journ. Clinique des Hôpitaux, tom. i. No. 17.

disappeared in consequence of compression by a tubercular disease at the base of the cranium;³ the trunk, and most of the branches of the portio dura of the seventh pair, have disappeared under the pressure of a fatty tumour, occupying the region of the carotid.⁴

It thus appears that, in cases of paralysis, the nerve generally withers, and this may arise from the pressure upon any part of the nerve by a foreign body, as in the case, recorded by M. Sanson, in which the decussation of the optic nerve was completely destroyed; or from the removal by interstitial absorption, (the subsequent supply of the nutritive vessels being imperfect) in conformity with a general law of the animal economy, that parts which have been little used, or from accidental cause have become useless, are gradually removed. For years I was subject to a painful affection of the soles of my feet, which prevented my walking without intense suffering. In consequence of the inactivity of the muscles of the legs, these withered and lost their firmness: the right foot recovering more speedily and completely than the left, the muscles of the latter remained smaller than those of the former. A lady, walking in the street, had her foot violently bruised by a piece of coal falling upon it from a height. She was unable to use her foot for some time, on account of the pain from inflammation; and at the end of a fortnight, to use her own expression, "her leg had gone away to nothing." It is the same with a nerve which has been rendered useless. Nature, conscious apparently of its inutility, removes it either by some increase in the activity of the absorbents, approaching in its character to ulcerative absorption, as in cases where the nerve is destroyed at the point of pressure; or, as more frequently occurs, by diminishing gradually the action of the nutrient vessels, so as to withhold from the nerve the usual supply of blood for its growth and nourishment, as in those instances where the nerve withers beyond the seat of injury, or between an organ, whose structure or office has been destroyed, and the sensorium commune.

³ M. Béclard, *Journ. de Phys. de Magendie*, tom. v. p. 17.

⁴ M. Billard, *Archives de Médecine*, tom. vi. p. 347.

Causes of Diminished Energy.

In tracing the causes of diminished energy in nerves, I shall consider palsies of particular parts only, to the exclusion of those cases which may be denominated general palsy, whether assuming the form of hemiplegia or paraplegia. The latter diseases, connected, as they commonly are, with extravasation, effusion, or disease within the cranium or spinal canal hardly fall within the scope of my present inquiry; but a consideration of them would afford strong collateral and confirmatory evidence of the views which I entertain of the pathological character of the former.

Paralysis "which affects less than half of the body, or some one particular part or organ,"⁵ has been denominated "partial palsy,"—a designation which has also been applied to those cases where there has been only diminished sensibility and muscular power, without a total annihilation of these functions. A term thus used, in contradistinction sometimes to more general, and sometimes to more complete and perfect palsy of the same part—sometimes meaning partial in extent, sometimes in degree without reference to extent, is somewhat equivocal, and therefore objectionable; and, upon the whole, it would probably be better to substitute, instead of partial, the word *local*, which conveys a more precise and accurate notion of that state, which has been well defined to be "a diminution, or an entire loss of the power of voluntary motion, or of sensation, or of both, in some particular part or parts of the body, without coma." It is true that, consistently with the strict rules of nosological accuracy, neither alternative nor negative propositions should be admitted into a definition; but medical definitions are generally abstracts of histories, and in that of Dr. Cooke, the leading features of the malady are pointed out; it includes in its terms both the complete and the partial paralysis, with the affection of one function of a nerve to the exclusion of another, and saves us the necessity of in-

⁵ Cooke on Palsy, p. 46.

stituting more minute subdivisions, which would encumber the memory without informing the judgment.

Local palsies occasionally arise *from affections of the brain or its meninges*; in conformity with the statement of Boerhaave, that “stupor and paralysis may arise in one particular muscle, and yet the fault may not be in that particular muscle, nor in the nerve, nor in the artery, nor in the veins, but in some particular part within the cranium.” Palsies from such cause require much attention and active treatment, as they are frequently the precursors of more general attacks, being amongst the threatening indications of an approaching apoplexy or hemiplegia, neither to be misunderstood nor neglected with impunity. These often manifest themselves, as is well known, in the retina or other nerves of the outward senses, in the eye-lids, the fingers, or the muscles of the tongue. Examples of these local paralyses from congestion, pressure, or disease of the brain, are sufficiently numerous. I shall content myself, however, with one striking illustration, which was mentioned to me some years since by Mr. Stevenson, the eminent oculist, of Margaret-street. A lady consulted that gentleman about some affection of her eyes, when his attention was much attracted by the extraordinarily slow articulation of the father, a clergyman from the country, who accompanied her. Upon inquiring of the daughter whether this was the father’s usual mode of utterance, she did not appear to be particularly alive to any great change; but now that her attention was directed to it, she thought his mode of speaking might be rather more distinct and slow than was common to him. Mr. Stevenson, however, confident that there must be something decidedly wrong in this, strenuously advised that this gentleman should consult some physician of eminence; and he had the advantage of the advice of my estimable colleague, the late Dr. Maton, under whose judicious treatment his tongue was straightway loosened, and his utterance quickened. Amongst other measures, he was enjoined to observe strictly the regulation of his diet, in which he was to be very abstemious; but upon one occasion, overtaken by a storm, he was driven for shelter into a confectioner’s shop, where, to insure

his welcome, he devoured a couple of oyster patties. He was soon after seized with fatal apoplexy; and upon examining the interior of his skull there was discovered an abscess of the brain of considerable size, completely circumscribed, and evidently of no recent origin.

But local paralysis is much more frequent from *injurious compression of nerves* in their course, after they have left the brain or spinal marrow; according to the simple and perspicuous statement of Galen, that "if a nerve be compressed by any hard body, which rests upon it, its function is interrupted." The observations and opinions of more recent writers upon this form of palsy, have tended to entangle a subject, in itself simple, in almost inextricable confusion. They have ascribed not only different, but even opposite effects to the same cause, alleging that these effects will vary not only in extent, but in kind, according to the degree of pressure. A minor degree of compression, it has been asserted, will often be accompanied with excitement of a nerve, involving as its consequences neuralgia, if it be a nerve of sensation; muscular spasm, if a nerve exclusively of motion; and the combination of the two, if the nerve affected be a compound nerve, ministering at once to sensibility and to muscular movement. Such being the supposed result of the smaller, it has been universally believed that a greater and more complete pressure of the trunk of a nerve would occasion a diminution of energy, in the form of either simple anæsthesia, or paralysis, or both. With a strange inconsistency, it was, however, at the same time generally conceded that this paralysis might be partial and imperfect from a less, but complete from a greater degree of pressure. It was further thought that, where sensibility was impaired or destroyed and the power of the muscles preserved, it was the result of a less degree of pressure than when both were affected. It was with them merely an affair of more or less; not of morbid affection of one set of filaments in the former, and of both sets in the latter. Even Mr. Abernethy was not aware that his packet of nerves consisted of fibrils of varied office; a point which it was left for the ingenuity and

discrimination of Sir Charles Bell, followed by Magendie and others, to illustrate.

It is obviously unphilosophical to ascribe not only different, but even contrary effects to the same cause ; and, as far as I have been able to ascertain, this prevailing dogma is not borne out by facts. A minute inquiry into the details of this subject, an examination of the numerous detached cases, to be found in the records of our art, point clearly to the conclusion that such contrary effects as pain and convulsive movement upon the one hand, and impaired sensibility with or without defective muscular power, upon the other are, in reality, as they might be expected to be, the result of causes differing rather in essence than degree ; and that whilst the former of these effects are the consequence of the various causes of excitement which I have already considered with some degree of minuteness, the latter are the result commonly of pressure. In the former case the function of the nerve is disturbed by a diseased condition inherent in itself ; in the latter, an undiseased nerve is compressed by some extraneous agent. The existence of disease in the nerve, whether it be simply thickened from inflammation, or the subject of morbid growths within its neurilemmatous investiture, will altogether alter the results of pressure, a slight degree of which, as has been already stated, will then produce agonizing pain, or violent spasms, or even in some instances, as in the case related by Dr. Short, an epileptic paroxysm.⁶ This distinction has been long familiar to my mind, and has not escaped the accurate discrimination of Sir Charles Bell, who has very briefly adverted to it in relating a case in which “ swelling of the parts within the orbit, *compressing* the fifth nerve, caused insensibility of the part of the face to which these branches were distributed, without affecting the motion.” “ When the tension and swelling subsided, there was returning sensibility ; but more than this, *the inflammation affecting the nerves* in their passage through the orbit, gave the sensation of excruciating pain, perceived as if

⁶ Ed. Med. Essays, vol. iv. p. 334.

in the face.”⁷ Still, even by this distinguished physiologist and practical surgeon, the difference is made a source neither of leading, nor even of prominent distinction; nor does he always keep it in view in his writings. Galen, too, was well aware of the difference of effect arising from compression upon the one hand, and inflammation upon the other; and he proposes the proper cure for the latter.⁸

This distinction of the effects of pressure upon a healthy, and upon a diseased nerve certainly deserves more attention than it has hitherto received, and should constitute an important element in our decision as to the propriety or preference of certain operations, as it will very materially modify the results. In a recent and very valuable paper by Mr. Travers, “On the Local Diseases termed Malignant,” is a case of medullary tumour of the ham. “It had been about two years and a half in growth, and *was, from pressure upon the nerves, become exceedingly painful.*”⁹ The pain was chiefly seated in the toes and outer side of the foot. The tumour was removed by careful dissection; the wound healed by granulation; the patient gradually improved in health, and soon afterwards became pregnant.” In this case it is obvious that the fibular nerve was principally implicated, and the symptoms would have induced in my mind the belief that the nerve was inflamed; and unless the inflamed nerve were divided above the seat of inflammation, some recurrence of the symptoms might be anticipated. I would not, indeed, assert that such division would have been proper, because the nerve may have been merely inflamed from long-continued pressure, without partaking of the malignant tendency of the original disease: in

⁷ On the Nervous System, App. p. lxviii.

⁸ Sed cum cerebro et medulla spinæ omnibus musculis non parva communicatio est, nam aut a cerebro aut a medulla spinæ nervum accipiant necesse est: qui visu quidem parvus, sed virtute minime parvus. Cognosces autem ex passionibus; nam incisus, oppressus, contusus, laqueo interceptus, schirris affectus, et putrefactus aufert musculo omnem motum et sensum. Quin et nervo inflammato non pauci spasmo correpti sunt et mente alienati: quorum quidam sic affecti cum sapientiore medicum nacti essent, nervo inciso statim spasmo et mentis alienatione liberati sunt; sed postea musculum in quem nervus insertuserat insensilem atque inutilem ad motum habuerunt.—*De Motu Musculorum*, lib. i. cap. i.

⁹ Med. Chir. Trans. vol xvii. p. 390.

which case, if the medullary filaments were not ulcerated through, the nerve might, upon the removal of the compressing tumour, recover its functional power; for, according to Haller, "*soluta vinculo, et in nervo non læso, musculorum usus restituitur.*"

That the operation diminished the patient's sufferings, although not distinctly stated, is to be inferred from the improvement of her health; but time was scarcely allowed for the complete restoration of the nerve to a healthy condition before this lady became pregnant, when again she "suffered from pain in the course of the sciatic and crural nerves,—so much so as to render the use of the limb very distressing. This was attributed *to the obvious circumstance of pressure*, and she was consoled with the prospect of its being soon relieved. However, on recovering from her accouchement, which was perfectly favourable, the incapability and, more particularly, the pain were greatly augmented. The pain followed especially the course of the nerves, but was diffused so as to render the slightest pressure upon any point of the surface intolerable." "There has been no delusion, or benumbing of sensation, such as pressure occasions; the whole character of the present complaint is neuralgia, and the only remedies affording any relief have been those of the tonic class."

This case is peculiarly interesting in several particulars. It shows what has been the general impression, and consequently the ordinary language with respect to the compression of nerves; and that it is often employed when the dependance of the symptoms upon pressure has been by no means ascertained. It is stated in general terms, as an undeniable, if not self-evident, proposition, that "the tumour was, from pressure upon the nerves, become exceedingly painful." But this statement involves two substantive propositions, one being the assertion of a fact, the second a mere expression of an opinion. It is a fact that there was pain; it is merely an opinion that the cause of that pain was pressure. The first admits not of question; the assertion, though somewhat ambiguously expressed, is conclusive. It was, perhaps, rather meant, that the tumour by pressure upon the

nerve had occasioned pain referred to the remote distribution of its filaments, than that the tumour itself was exquisitely painful. That simple compression, however, occasioned the pain, requires evidence in its support ; but no other proof is offered than that there was a tumour, and that there was pain ; and yet "there was no delusion or benumbment of sensation, such as pressure occasions." Still, notwithstanding the absence of these notorious effects of compression, the intelligent author of the paper on malignant diseases referred the original painful affection of the nerve to that cause, and appears at least to assent to the proposition, that its subsequent return with aggravated violence during pregnancy was also owing to "the obvious circumstance of pressure." But the pain returned or continued after the causes of pressure had ceased to operate ; first, upon the removal of every vestige of the tumour, and afterwards in consequence of the delivery. Even, therefore, if the original painful affection of the nerve was the *indirect* effect of pressure, which is not improbable, it must afterwards clearly have been kept up by some other cause. The observations I have already made upon the subject of the inflammation of nerves render it extremely probable, that inflammation, glueing the nerve to contiguous parts, was that cause ; and this probability is reduced almost to certainty, when it is considered that after the removal of the suspected causes of pressure—the malignant tumour and pregnancy—the sufferings returned, with even "aggravated violence," not only in the branches of the nerve within the range of the tumour, but also in those of the anterior crural nerve, which was completely yond its reach. Such being the condition of the nerve, as in all similar instances, the slightest pressure either from within or without would produce a paroxysm of pain, or aggravate the suffering.

Analogous facts were observed, and similar opinions entertained by the late Mr. John Pearson with regard to the instances, which he has minutely detailed, of what, since his time, has been described by Mr. Wood and others under the designation of painful subcutaneous tubercle. The symptoms seated in the leg were very similar, were aggra-

vated by pregnancy, and came on without assignable cause several times in the day. It was also observed that the severity of suffering was increased not only during pregnancy, but even during menstruation; and that in the latter months of gestation the duration of each paroxysm was extended to an hour and a half. "Each of these attacks was accompanied with an increased redness, and a sensible elevation of the indurated part; and the paroxysms of pain were excited by every thing that accelerated or otherwise disturbed the circulation of the blood, whether applied to the induration, or affecting the general system; as, all strong exertion of the muscles, external impulse, or mental commotion." Mr. Pearson, however, in conformity with the opinions then, as now, prevalent "that a certain degree of pressure upon a nerve will produce pain, spasm, and convulsions," considered that all these causes acted upon the principle of compression; the nerve, though surrounded by inflammatory thickening, not being in a diseased condition. In pregnancy he thought the aggravation of the symptoms was owing to distention of the vein, which, together with the nerve, was "included in the tumour. This fact was clearly demonstrated after the exfoliation of the eschar; for he then saw a portion of the vein hanging down at the superior part of the sore, and the naked nerve in contact with it." He further imagined, that during parturition the sufferings of the patient were increased by the greater quantity of blood sent to the part by the violent action of the heart and arteries, for then, "to use her own expression, she had 'all her labour pain in her legs.'" Thus the increase of pain is referred to mere venous distention at one time, to vehement action of the arterial system at another, both, however, being supposed to act upon the simple principle of pressure; for, adds Mr. Pearson, "we may, perhaps, venture to conclude, that the vein and the nerve being confined within a substance that could not easily be distended, whenever the vein became preternaturally turgid, the nerve was compressed between its parietes and the internal surface of the induration; and that, consequently, the symptoms were connected with this state of the part." The proof, how-

ever, of the distention of the vein is very unsatisfactory and, indeed, is only offered as a probable explanation in these terms: "it is *highly probable* that the portion of vein which passed through the tumour was unusually distended with blood at the time of the paroxysm; for upon these occasions the morbid surface became redder than common, and the tumour was sensibly elevated." Now, without entering into any minute critical analysis of this sentence, it may suffice to state, that there is no proof adduced of such enlargement of the vein, and that, in another case, although it was suspected that the tumour might be connected with the saphena minor, and might, consequently, "include or compress a small branch of the sciatic nerve," yet, as the cutaneous veins of the leg could not "be rendered turgid by moderate pressure, its exact situation could not be ascertained." Besides, mere distention of a venous trunk does not produce surrounding redness; redness may occur without venous enlargement; and, above all, this redness, with even slight intumescence, is of constant occurrence in parts the subject of neuralgia, where there is no tumour to be influenced and no contiguous trunk of a vein to be distended. The redness noticed by all the best authorities, including Earle, Swan, and Descot, is now universally ascribed to an increased action of the arteries of the part, and is generally the consequence, rather than the cause of the attack. I know that upon this point there has been some discrepancy of opinion, and that Mr. Earle is disposed to think it rather the cause than the consequence; but in general the weight of testimony is in favour of the opposite relation, although occasionally, and by reflex influence, vascular excitement may also aggravate a paroxysm. An attack of neuralgia of the face has been very frequently induced by a current of cold air, which can hardly increase the circulation in the part, by the slightest touch, as in Mr. Wardrop's case, by the pressure of the stocking, or the bed-clothes, as in one of the instances which fell within my own observation, and in one related in Mr. Wood's communication in the *Edinburgh Journal*; and in these it must be clear

that the impression was made first upon the nerve, and that the redness was a secondary effect.

But in combating an impression so general as that which I have been considering, it may be requisite that I should examine more at large the evidence upon which it rests; and I shall do so with, I trust, becoming deference to the opinions of my predecessors and cotemporaries, who are perhaps, after all, better able to come to right conclusions upon the subject. One of these, whose eminence as a surgeon and whose erudition have raised him far above either my censure or my praise, thus represents the state of our knowledge at the period at which he wrote:—"I do not suppose (says Mr. Pearson) that it will be necessary for me to undertake a proof in detail, that a certain degree of pressure upon a nerve will produce pain and spasms; it may be sufficient for my purpose to refer to a few of the many instances which are recorded in medical books."¹ Of these he has collected many examples with which his literary habits readily supplied him; but it will be seen in the sequel how little they bear him out in the enunciation of his principle, which he evidently believed to be of universal application. His first case was one not of extraneous pressure upon a healthy nerve, but a disease which I have already noticed amongst the causes of excitement—the hard, gritty, or cartilaginous tumour of the nerve itself; and cured, not by the excision of the tumour to the exclusion of the nerve, but, as Mr. Pearson himself states, "*by removing the tumour and dividing the nerve.*" Had the disease consisted merely of a tumour covering and compressing the nerve, without their being glued together by inflammation, or without the tumour being incased in the substance of the nerve, there could have been no necessity for dividing and removing a portion of the nerve, as was done, together with the tumour; the removal of the latter would have been sufficient. It appears, however, that Dr. Short thought it requisite at least to divide, or rather to excise the portion of the nerve on which the disease was seated. "It was a hard cartilaginous substance, or ganglion, seated on a nerve

¹ Med. Facts and Obs. vol. vi. p. 101.

which I cut asunder, and took out the tumour." The pathological character of this substance identifies it as a disease of the nerve itself; for the tumours of smaller size, which are frequently found in the substance of nerves, are commonly gangliform enlargements of the nerve itself, of a gritty or cartilaginous hardness; according to the majority of the French writers, of a scirrhus character and even essentially carcinomatous, blunting the knife with which they are cut, and producing, when cut into, a grating sound like the cutting of bone or gristle. Besides, the case was one of general epilepsy, rather than either of neuralgia or of muscular spasm in the parts supplied by the nerve affected, and is therefore little allied to either painful or paralytic affections of nerves.²

Still less does the case quoted briefly from Guattani afford even corroborative evidence of the truth of Mr. Pearson's general statement; for in that instance, if the morbid condition was really that of pressure, it is clear that the nerve must have compressed the tumour, rather than the tumour compressed the nerve. In the delineation of the parts which accompanies and illustrates that case, the popliteal nerve is distinctly represented running over the aneurismal tumour, upon which it was expanded like a girdle. The nerve was flattened by gradual extension, so as to be at least three quarters of an inch wide, and seems from the engraving to have adhered to the surface of the tumour. This circumstance renders it more than probable that inflammation had occurred in the nerve itself, and this opinion is much confirmed by the following considerations:—1st. That although there was pain near the tendo achillis, yet no violent spasms occurred in the limb until after the application of strong pressure to the tumour, with a view to the cure of the aneurism by the obliteration of the artery; and it is unnecessary to point out how likely this kind and degree of pressure was to aggravate, if not to produce, inflammation of the nerve thus expanded over the tumour, and thus subjected to such powerful compression. 2ndly, That this was the only instance of popliteal aneurism in which Guattani, with all his experience, had ever met with such

² Edin. Med. Essays, vol. iv. p. 334.

convulsive pains, which must have occurred, if “a certain degree of pressure upon a nerve will produce pain, spasms, and convulsions.” 3rdly. That Guattani, assures us of the impracticability, in that instance, of tying the vessel without including in the ligature both the nerve and the vein; and lastly, that the tumour could not even have been opened without wounding the expanded nerve.³

These were the impressions upon the mind of the author, from an examination of the parts after death; and such observations would have been little better than absurd, if the nerve had really not been agglutinated by inflammatory adhesion to the surface of the aneurism, over which it was spread. Had it remained loose and movable, though stretched, it surely could have been pushed to one side during the operation, as the par vagum and other nerves are frequently held beyond the reach of the knife in surgical operations upon contiguous tumours or arteries; and this could not have escaped the sterling common sense of Guattani. Besides, the vein was tied by inflammation to the tumour, and it was this adhesion which rendered the application of a ligature, without including the vein, impracticable: it is probable, therefore, that the nerve also adhered to the tumour, and that this would have rendered it impossible to tie the vessel, or even to open the tumour for the purpose of securing the artery, both above and below the opening, without also including in the ligature or the incision the nerve itself.

The next instance upon which Mr. Pearson relies, as a proof and illustration of his opinion, is thus noticed.—“In the *Essays and Observations, Physical and Literary*, vol. iii. the late Sir John Pringle has published a case where a tumour, formed by extravasated blood, by pressing upon the intercostal nerves, produced pain, irritation, and, perhaps, hiccup, which could not be stopped.” Few would suppose from the terms in which this case has been alluded to, that it was an example of aneurism of the abdominal aorta, communicated by Dr. Do-

³ Ad perficiendam vincturam necesse fuisset nervum venamque simul constringere.—Multo minus expediebat methodum aggredi aperiendi tumoris, quod hoc in casu fieri non poterat quin necessario ita expansus nervus in ipsa apertione dissecaretur —Guattani, in *Louth's Collection*, p. 165.

nald Monro amongst his "Cases of Aneurisms, with remarks;" or that by the intercostal nerves" Sir John Pringle meant merely the visceral nerves of the abdomen; or that the supposition of the dependance of the pain, irritation, and incurable hiccup upon pressure, was purely a conjectural opinion, and *that* but an alternative conjecture. No direct connexion between the tumour and any particular nerve was traced upon dissection; but "upon a review of the whole," it was concluded, "that this tumour growing larger, and in time *pressing upon the intercostal nerves, or upon the transverse flexure of the duodenum*, it occasioned the hiccup, which could never be stopped, as the irritation was always increasing." That Sir J. Pringle alluded to the splanchnic nerves generally, is clear from the situation of the tumour, the upper boundary of which being the emulgent arteries, it could not have affected in any way the nerves either of the stomach or the diaphragm, with the morbid affections of which, excepting in states of extreme exhaustion or of sphacelus, we find hiccup to be so commonly associated. It is infinitely more probable that in this case the constant pain, which is represented to have been towards the left side, was the result of that inflammatory affection which caused the adhesion of the tumour to the duodenum, and that the hiccup was the natural consequence of that distention of the stomach which resulted from mechanical obstruction of the alimentary canal at its upper part.⁴ If any direct influence had been exerted upon the nerves within the cavity of the abdomen, it might have been anticipated that those of the lower extremities would have been principally affected; and so in reality it happened, for "sometimes he mentioned a numbness in his feet." This last fact adds to the improbability that the spasmodic affection of the diaphragm, which is the essence of hiccup, should have been produced by the pressure upon nerves, as this would imply contrary effects from the same cause—excitement, pro-

⁴ This tumour was of a firm consistence, beginning as high up as the emulgent arteries, where it *adhered* to the transverse flexure of the duodenum, and from thence descending till it came near the pelvis.—*Ess. Phys. and Lit.* vol. iii. p. 206.

ducing convulsive movement, above the tumour; defective energy, amounting to paralysis, below it.

As to Dr. Bissett's interesting case, it is just an example of the "painful subcutaneous tubercle" the nature of which was not satisfactorily determined, although Camper had distinctly asserted that these "*tubercula intra nervorum tunicas sedem habent.*" It is not therefore an instance of simple pressure upon an adjacent healthy nerve, but rather a morbid interstitial deposit in the nerve itself, rendering it peculiarly sensitive to the slightest impression; so that "on being rudely touched with a finger or the skirts of her petticoat the spasmodic pain was instantly excited."⁵

The string of references, which the erudition of Mr. Pearson enabled him to supply in a foot note to his interesting and valuable communication, has little relation to the immediate subject under consideration. The cases are either instances of irritable painful tumours, or diseases producing in sensitive habits great nervous disturbance and sometimes even epileptic paroxysms, implicating in some instances contiguous nerves in the same diseased action, and cured by excision, escharotics, or the actual cautery; or they are examples of that indefinite, and to this moment altogether unintelligible state of particular nerves, called the ["aura epileptica," which, in those who are liable to epileptic attacks, so frequently ushers in a paroxysm. But there is not one of the cases, or general statements, thus referred to, which gives any countenance to the opinion, that "a certain degree of pressure upon a nerve will produce pain, spasms, or convulsions."

It thus appears that the cases, accumulated by the industrious researches of Mr. Pearson, are not sufficient to establish the conclusion that *any degree* of pressure upon a *healthy* nerve will produce excitement: nor are the arguments or observations of Mr. Swan more satisfactory. The chapter devoted by the latter writer to the subject of compression wants much of his usual clearness, and even contains something approaching to contradiction in the description of its effects. The details upon the subject are introduced by an

⁵ Mem. of the Med. Soc. London, vol. iii. p. 60.

account of the effects of "extension," which Mr. Swan appears to think the same or synonymous with pressure. After stating that "a nerve may be extended some way without giving pain or inconvenience," he adds, "but when a nerve *is extended* in any considerable degree, pain is excited; and if the extension be increased, the pain is increased in proportion, till at length the nerve begins to ulcerate; and *if the pressure be not removed*, it becomes almost destroyed by this process." In his description also of the symptoms of pressure, the statements are either obscure, or they are contradictory. Thus "when a nerve is *pressed against a bone* for a short time, an uneasy sensation is produced, and the parts to which it is distributed feel benumbed. When the pressure is continued longer, these parts entirely lose the power both of sensation and motion; but if it has not been very violent, they will recover;" and yet though impaired sensibility and defective muscular power are thus described as the consequences of the pressure of a nerve against a bone, it is subsequently asserted that "people frequently complain of *pain* in the lower extremities, which is sometimes *very excruciating*. It is often occasioned by the use of tight garters, *which press the nerves against the bones*. But although these two statements appear at the first glance contradictory, yet the contradiction is only apparent, and readily admits of explanation. Both assertions may be true: pressure upon a healthy nerve produces enfeebled energy, but long-continued pressure, as from tight garters, occasions the nerve to inflame; and it has been already shown that pressure upon an inflamed nerve is not only painful at the point of compression, but is often also productive of neuralgia in its remote distribution. All the cases, adduced or quoted by Mr. Swan, in which pain attended compression of a nerve, will bear this interpretation of the symptoms. The first is an instance of severe pain in the toe, from thickening of the corner of the nail, which had occasioned "an indentation in the flesh about the size of a pin's point." It was, in fact, in essence, a corn, only formed by the nail, instead of an inverted cone of hardened integuments, and pressing upon the subjacent sensitive tissues; and it is scarcely possible to

doubt, that if the nerve in this case was affected at all, it was either from the continuous mechanical irritation of this "pin's point," or the nerve had become the subject of inflammation from the same cause; just as inflammation was produced by a gooseberry thorn, in the case recorded by Mr. Wardrop; by an angular piece of porcelain, in that related by Mr. Jeffries; by portions of the alveolar process, in those adverted to by Mr. Swan; and by decayed teeth, in the highly-interesting and instructive example detailed by Mr. Mitchell, as well as others alluded to by Swan and Descot. In the second case—a painful affection of the left leg—the fibres of the *psoas magnus*, and the small *psoas* muscle, were put upon the stretch by the tumour, with the walls of which "some of the origin of the anterior crural nerve *appeared as if incorporated*, and the body of the second lumbar vertebra was ulcerated; both circumstances rendering it highly probable, and all but certain, that the nerves were inflamed.

The quotation from Lobstein merely states the facts, that the nerves of the crural plexus may remain uninjured in the midst of lumbar abscesses, but that in cold, steatomatous, and other tumours, the nerves may be wasted, too dry, flattened, applied or agglutinated to the tumours; and that in abscesses situated near the spine, and arising from caries of the vertebræ, the nerves are sometimes destroyed.

In the case of aneurism of the aorta, extracted from Scarpa's work, the pains in the lumbar region, stretching over the abdomen, were traced, upon dissection, to be owing to "the effused blood, which had formed deep excavations in the substance of the left *psoas* muscle, *so as to disorganize* the lumbar nerves, and *injure* the anterior crural and obdurator nerves.

In Portal's case, the pain in the great toe of the left foot after eating is referred to the pressure by the last false ribs on the sigmoid flexure of the colon, producing compression of the lumbar plexus. But it must be borne in mind that there was also great curvature of the spine, involving disease of the vertebral column; and in this disease the origin of the lumbar nerves may have been implicated. This is rendered more

probable from what was observed in Scarpa's case already referred to, and the instance I have quoted from Ollivier. Besides, I have seen no less than three instances, where the colon was so large and so hard at this part as to have been pronounced to be instances of ovarian tumour. Much pressure upon the nerves must here have been produced, and yet neuralgia attended neither; and the same observation will apply to those examples of minor distention of the sigmoid flexure, which are of every-day occurrence, but are unattended with any pain which can be referred to an affection of the nerves, although numbness, in a greater or less degree, is no uncommon result of pressure under such circumstances.

In the instance of pain from fracture of the glenoid cavity, there cannot be the shadow of a doubt that the nerves in the vicinity were first contused or crushed, then inflamed: just as in the case quoted from Mr. Earle it is expressly stated, as matter of belief, that the same blow, which had fractured the calvicle, had lacerated or crushed the axillary plexus of nerves, as they pass under that bone.

The case of paraplegia only proves that pressure in one degree produces enfeebled nervous energy, and that additional pressure renders the palsy more complete and unmanageable; that of partial paraplegia, from lying on the damp ground, can give no countenance to the notion that pressure upon a healthy nerve occasions pain; and the last instance recorded by Mr. Swan, is one simply of paraplegia, from sanguineous congestion within the spinal canal.

The very prevailing impression, that pressure in one degree upon a nerve occasions pain, in a greater degree paralysis, is vague and indefinite, as the difference of degree cannot be made the subject of estimate or description; but it is, probably, also erroneous, and perhaps, after all, it would be difficult, with all the new lights of modern physiological science, to improve upon the more intelligible, because more perspicuous statement of Galen upon this point, that "when nerves are compressed by ligatures or the hand, by a phlegmon or a schirrhus, by dislocations or fractures, they *all* become in the first instance torpid, and are afterwards altogether deprived of sense and

motion; and such affection of the nerves is called paralysis:⁶ but when a nerve is inflamed, the patient frequently suffers from spasm and alienation of mind, and if he be fortunate enough to fall under the care of an intelligent practitioner, who will divide the nerve, the patient is cured of his spasm and mental disturbance, but the muscle upon which the nerve is distributed loses afterwards its sensibility and power of action."⁷

But this, after all, is a question to be settled not by authority merely, but by an appeal to experience; and the mode of ascertaining the effects of pressure, which would naturally suggest itself to the mind of one who is engaged in the investigation of these points, is the application of a ligature upon the nerve. The effects of ligatures, however, vary according to so many adventitious circumstances connected with their application, that the inferences deduced from them are unsatisfactory. These effects, for instance, are materially modified by the degree of tightness with which the ligature is drawn, and by its thickness; but it is universally admitted, that if drawn with a sufficient force, and with a string sufficiently small to overcome the protecting influence of the neurilematous covering, the consequences are the same as those produced by a complete solution of continuity of a nerve. The direct and immediate effects, therefore, of the complete division or removal of a portion of nerve being identical with those of the effective application of a ligature, any observations or reasoning which are legitimate and true of the one, will be equally applicable to the other; and as the division or excision of a portion of nerve always involves, as its necessary consequence, the annihilation of its function below the seat of

⁶ Si autem a duro aliquo corpore, quod illi extrinsecus innitatur pressus sit (nervus) ne sic quidem virtutis transitus non morabitur. Proinde nervi, qui vel funiculis vel manibus sunt constricti; et qui ab externo aliquo, quod vel phlegmone sit obsessum vel cum sensus noxa duratum, (schirrhum vocant) premuntur, et qui aut luxatis aut fractis ossibus angustantur, omnes principio quidem torpent, postea vero omnino sensus motusque expertes fiunt. Et vocatur quidem ejusmodi nervorum vitium, Græce, paralysis, id est nervorum resolutio. *De Sympt. Causis*, lib. i. cap. 5.

⁷ De motu musculorum, lib. i. c. 1, already quoted.

injury, so also it may be inferred that paralysis will be the inevitable result of the efficient application of a ligature. Thus, to say nothing of the experiments of physiologists, the surgeon in his operations has, in some instances, included inadvertently a nerve in the ligature which was intended to remove a tumour, or compress an artery. An instance of this is related by Morgagni:—A ligature was applied by Val-salva upon the brachial artery, on account of an aneurism produced by a wound in the artery in bleeding. “All the parts below the ligature lost their faculty of sense and motion as soon as it was tied, and the extremity became cold a few hours afterwards.”⁸

There are several sources of fallacy connected with the application of ligatures, which rarely influence our deductions in cases of division or excision. If the ligature be thick, or not tied with sufficient force, or the nerve be very large, the medullary fibres connected with the neurilema, may not be sufficiently compressed to intercept completely their function, which in such cases may be only impaired, not destroyed. But even in these cases the immediate consequences are more frequently those of enfeebled energy than excitement.⁹ In such cases the function of the nerve is commonly restored at no very remote period, as might be expected, seeing that the continuity of the medullary filaments has not been completely interrupted. Still, the ligature in these cases must have ulcerated the nerve through, to allow of its escape from the wound; but it is not difficult to understand, nor hard to believe, that as the ligature advanced by very slow degrees through the nerve, the part behind may have gradually united

⁸ Frequentia etiam experimenta sunt, quæ, vinculis nervo injectis fiunt. Tunc enim partes omnes musculi qui nervos suos a trunco nervi ligato accipiunt, resolvuntur paralyticæ neque porro a voluntate in motum cieri possunt.—Haller, *Elem. Phys.* vol. iv. p. 322.

When a nerve has been included in a ligature, the parts to which it is distributed are deprived of sense and motion, in the same manner as if they had been divided.—*Swan on the Diseases of Nerves*, p. 145.

⁹ La ligature d'un nerf, même volumineux, ne produit pas les convulsions, les spasmes, et autres accidens graves que les pathologistes se sont plus à attribuer à ce genre de lésion.—*Descot*, p. 109.

before the separation of the remainder,—an opinion rendered the more probable from the observations of Mr. Swan, that before the ulcerative process commences, and the ligature consequently becomes loose, “immediately the vessels of the injured portion of the nerve begin to enlarge and become more numerous, and coagulable lymph to be effused, and *“the ligature becomes incased by the lymph”* which forms the medium of communication between the portions above and below the ligature. “In an experiment seventy-two hours after the application of the ligature, the separated portions had been united by lymph and the vessels had anastomosed.”

There has been considerable difference of opinion, and even some controversial discussion, as to nature's mode of reparation in these cases of re-union, whether after ligatures or division with a knife. All are agreed, however, that the first change is an effusion of lymph which becomes organized; but whether new medullary matter is subsequently deposited has been the matter of dispute. Meckel has marshalled the forces on each side of the question. He represents Cruikshank, Haighton, Fontana, Michaelis, Monro, and Mayer to be in favour of partial or imperfect reproduction of nervous matter: Arnemann decidedly rejects the opinion, asserting that cellular tissue, condensed by inflammation, is the sole mode of communication; whilst the opinion of Meckel himself is, that the last of the series of changes which completes the restoration of the nerve, consists in a conversion of the substance deposited into true medullary matter.¹ The decision of this question is of secondary importance; it is enough that the intermediate substance performs the office of nervous matter, communicating to the sensorium the impressions from without, and conveying from within the mandates of the will to the muscles influenced by the nerve, which has been tied or divided. Mr. Swan is of opinion that the communication is carried on not only through this “new formed substance,” but also that

¹ Les expériences rapportées plus haut semblent autoriser à croire que cette substance nouvelle, d'abord homogène dans les plaies de tous les organes, peut finir par se convertir, peu à peu, en véritable substance nerveuse.—Meckel, *Manuel d'Anatomie*, &c. vol i. p. 285.

“ in some instances new nerves are formed to keep up a communication with the brain.” This opinion, however, requires the confirmation of more numerous experiments and observations, than have been hitherto collected upon the subject. It appears quite within the bounds of possibility that those described by Mr. Swan may have been minute nerves, now first perceptible in consequence of the enlargement, consequent upon either inflammation or exertion; for “ nerves may become enlarged from irritation in the same way as the muscles from continued action, without losing their healthy character.”²

Other modes of compression, as might be well expected, produce similar results,³ and this in whatever part of its course, from its origin to its distribution, the nerve may happen to be subjected to pressure. The positive evidence upon this point is so abundant and conclusive, that I might almost content myself with referring to the familiar examples, to which I have already had occasion to advert, of pressure during sleep upon the sub-occipital branches of the upper cervical nerves, or upon the ulnar, the radial, or sciatic nerves, which invariably produces a diminution or negation of nervous influence, whatsoever may be the degree of compression from the chair or table.

Other causes, not extraneous to the body, may compress a nerve in its course and, by obstructing the communication of nervous influence, paralyse the parts upon which it is distributed; and if the nervous cord be minute and thready, a very slight degree of pressure may suffice. An instance of this occurred to me in a fatal case of the crowing inspiration, in which

² Swan on the Diseases of the Nerves, p. 11.

Eadem fiunt si pro vinculo alia quæcunque causa nervum compresserit.—*Haller, Elem. Phys.* vol. iv. p. 322.

Quidquid ergo vel nervi continuitatem solvit, vel comprimendo ejus cavum delet paralyisin faciet illius muscoli, cui talis nervus prospiciebat.—*Van Swieten, Comm.* vol. iii. p. 358.

La propagation des impressions externes ou internes est interrompue quand la continuité ou les connexions viennent à cesser entre la partie centrale et les organes en général. De là la perte du sentiment, du mouvement, et de la faculté sécrétoire, aussitôt que le nerf d'un organe vient à être coupé ou comprimé, soit par une ligature, soit par une tumeur voisine dans son trajet, à son origine, ou à son entrée dans l'organe.—*Meckel, Manuel*, vol. i. p. 263.

an inflammatory effusion at the base of the brain, near the foramina leading from the cranium to the orbit, although it produced no sensible effect upon the optic nerves or the common trunk of the *motores oculorum*, was yet sufficient to paralyse the separate filaments, which supply the superior recti muscles of the eye. This effect of the thickening of surrounding parts from inflammatory deposits around a nerve is amply illustrated in those cases of facial paralysis, which are of frequent occurrence, and only of late years well understood. A very interesting example of this has been detailed by Dr. Percival;⁴ and it is not of the less value that the facts were recorded before the ingenious researches of Sir Charles Bell upon the peculiar functions of the fifth pair and the *portio dura* of the seventh were generally known to the profession. It occurred in an unmarried female of seventeen, of fair complexion of sensitive and irritable habit but robust form, in consequence of exposing herself, whilst overheated and perspiring from exercise, to a current of cold air which passed from an open window chiefly over her head and neck. On the following day she experienced some uneasiness from stiffness of the muscles in the parts which had been exposed; pain and swelling gradually supervened, and were followed in the course of a week by torpor and paralysis of the entire left side of her face, scalp, fauces, and neck. At the end of another week Dr. Percival first saw her, when "he found her face considerably swelled, her head drawn to the right side, her articulation very imperfect, and her power of deglutition and swallowing so much impaired that she could suffer only small portions of liquid, and by great effort, to pass down her throat." The inflammation was in this case confined to the textures surrounding the nerve, without implicating the nerves themselves. Had it been otherwise, the inflammation would have manifested itself in the production of the symptoms of excitement, and as the nerves affected were motor nerves, convulsive movements would have been the result, as happened in a well-marked case of inflammatory affection of these nerves, which in the same volume of the *Medico-Chirur-*

⁴ Med. Chir. Tr. vol. iv.

gical Transactions immediately succeeds the communication of Dr. Percival. This patient, fifty years of age, was seized suddenly with an affection in which *she felt* something drawing her tongue and mouth to the left side; it took her speech away, and her face shook very much. She had afterwards, in the progress of her complaint, twitchings of the occipito-frontalis and orbicularis muscles, her tongue was drawn forcibly in a curved direction towards the left molares, the teeth were clenched, and the lower lip much distorted by a strong spasm in the left depressor anguli oris, and depressor labii inferioris; the eyes also became affected, as did also the muscles of that side of the neck, so as to draw the head "round to the left shoulder, occasioning an appearance as if the left ear and chin were about to recline on the point of it." It was suggested by Dr. Thomas, in consultation with Mr. Mitchell who narrates the case, that some local irritation of the nerves of the mouth might produce the complaint. Upon examination it was found that all the teeth on the upper and left side of the mouth were in a decayed state and highly sensible when touched with a probe, and the gums inflamed and irritable. The symptoms gradually ceased as these sources of irritation were removed, and eight days *after the extraction of the last of seven teeth* the gratifying report is first recorded, that "the patient has lost all spasmodic action."

These two cases, thus placed in juxtaposition and contrast, are so interesting in themselves, that it is scarcely necessary to invite attention to them. The same set of muscles were implicated in both. In the first they were paralysed in consequence of being, to use an expression of Mr. Swan, "strangulated" in their course by the compression of surrounding inflammatory deposits; but this not until a week had elapsed from the period of exposure, when active inflammation had subsided, and when intumescence alone remained. As the swelling disappeared, the nerves recovered their energy. In the latter case inflammation at the roots of numerous teeth upon the side affected, of the gums, and probably of the alveolar processes themselves, had extended to the contiguous nerves of the fifth and seventh pairs. These were morbidly

excited, and associated in their disordered function those muscles of the neck, shoulders, and chest, and probably the diaphragm, which are largely supplied with energy from the respiratory system of nerves.

Such instances of paralysis of the muscles of one side of the face, from exposure to a current of cold air, are by no means uncommon. Three cases have been recorded in the fifth volume of the Medical Transactions; and Mr. Shaw and subsequently, Sir Charles Bell have multiplied instances of the same kind; so that the point is at length proved, by an extent of cumulative evidence which is perfectly irresistible, that paralysis may be induced by the accumulation and confinement around nerves, so as to occasion pressure, of the products of inflammation. Nor does it appear less clear that if the inflammatory affection of surrounding textures extends to the same nerves, spasm may be excited; at least it occurred in the case related by Mr. Mitchell; in one referred to by his associate in the consultation; and in a third mentioned by M. Descot, which was also cured by the extraction of a carious tooth. If any additional proof were required of both these propositions, it would be found in the circumstances of a case already briefly noticed, in which Sir Charles Bell draws the distinction between the effects of pressure upon one nerve, and of inflammation in another produced by the same malady. The patient suffered from an ulcer of the character of "*noli me tangere*" or "*lupus*," which extending into the orbit, completely displaced the eye. "The swelling of the parts within the orbit compressing the fifth nerve caused insensibility of the part of the face to which these branches were distributed, without affecting the motion. When the tension and swelling subsided there was returning sensibility; but more than this, the inflammation affecting the nerves in their passage through the orbit gave the sensation of excruciating pain perceived as if in the face. An inflammation of a nerve does not give perception of pain in the proper seat of the disease, but in the part to which the extremity of the nerve is distributed."⁵

That tumours of various kinds, pressing upon healthy

⁵ On the Nervous System, App. lxxvii.

nerves in their course, will produce paralysis in the parts which they supply, is so well known as scarcely to require proof, and an appeal, therefore, to a few of the numerous cases which are upon record will suffice to verify the assertion. Amongst those about which there can be the least dispute, as both the cause and effect are abundantly obvious to the senses, is the paralytic affection of the portio dura of the seventh pair. The first in the series of admirable pathological illustrations of the views of Sir Charles Bell, contained in the appendix to his work upon "The Nervous System," is of this kind. The local palsy was produced by a gland situated between the angle of the jaw and the mastoid process, and enlarged from mercurial irritation within the mouth.⁶ In a second instance, communicated by Dr. Malden, in whom I recognise a cotemporary who has not disappointed the expectations formed of him when in Edinburgh, the paralysis of the face is said to have been "produced by a hard, fixed, and indolent tumour, lying between the ramus of the lower jaw and the mastoid process of the temporal bone." "In a fortnight the tumour disappeared, and with it gradually the paralysis of the face."⁷ In a third, transcribed from the "Pathological and Practical Researches on the Diseases of the Brain and Spinal Marrow," by Dr. Abercrombie, it arose from a tumour under the ear, of the size of a small bean, very firm, and of an ash colour. It lay directly above the facial branch of the portio dura, and there was considerable appearance of inflammation in the cellular membrane surrounding the nerve; but "*without any deviation from the healthy structure in the nerve itself.*"⁸ In a fourth, an enlarged gland, tender on pressure, just between the mastoid process and the upper portion of the lower jaw, produced the same effect.⁹ In a fifth, the paralysis was the result of an enlargement with induration of the parotid gland. Upon other causes of pressure affecting these nerves it is unnecessary to enlarge; but amongst them have been mentioned mechanical injury and subsequent inflammation; abscess, especially if with a hardened base; tumours

⁶ Ib. p. iv.⁷ Ib. lxx.⁸ Ib. xciv.⁹ Ib. xcvi.

imbedded in the substance of the parotid; and inflammatory thickening within the bony canal, through which the nerve has to pass before it escapes by the stylo-mastoid hole to be distributed upon the muscles of the face. The number and variety of causes, which thus produce paralysis of the respiratory nerves of the face, occasion this to be amongst the most frequent of local palsies, and afford us ample opportunities of investigating its phenomena:—and it is worthy of remark, that, in no single instance of a tumour existing in the course of this important motor nerve of the face, has that tumour any other effect upon the nerve, than that of enfeebling or annihilating its influence. The symptoms, whatever may have been the degree of pressure, have never been those of convulsive movement from excitement, but always paralysis from pressure.

Illustrations of the same pathological principle—that simple compression of a healthy nerve impairs or destroys its function, according to the degree of pressure—may be derived from the numerous causes which are capable of producing amaurosis, amongst which are enumerated, by the highest authorities upon such subjects, turgescence of vessels, especially of those which constitute the circle of Willis; thickening of the membrane surrounding or in contact with the optic nerves; encysted or other tumours compressing the same nerves; caries of the os frontis trenching upon the optic foramina; deposits of serum or other fluids; induration, or other disease of the thalami; and a gorged state of contiguous parts of the brain. In general these causes are slow in their operation, and the amaurosis proportionally gradual in its progress; but upon other occasions the cause of pressure is more speedy in its influence, and the effect is in proportion rapid, the loss of sight being even sometimes almost instantaneous, as I have known in more than one instance of puerperal convulsions, and even in that state of sanguineous congestion of the vessels of the head sometimes occurring in advanced gestation, a melancholy example of which I have recently had an opportunity of seeing in the family of a professional friend.

Many other causes of pressure might be enumerated and

illustrated, but it is unnecessary to adduce them, as the principle is too well understood and universally conceded to require such additional confirmation. I shall conclude, therefore, this abstract of the pathology of nerves by inserting the masterly, though diffuse, sketch of their morbid conditions by an eminent French pathologist, who says,—“Nerves, as well as the parts whence they derive their origin, may be compressed, indurated, softened, enlarged, attacked with inflammation, suppuration, gangrene; they may be contused, wounded, compressed at their origin together with the brain or spinal marrow, in their passage through the foramina of the cranium or of the vertebral canal, and along the rest of their course, whether in the cellular tissue or in the viscera, and in fact in every part of the body exposed to congestions and causes of compression.” And again—“Nerves may be compressed by tumours in general; by distention of vessels; by the violent contraction or displacement of muscles; by dislocations, fractures, exostoses; by foreign bodies, shot, and balls; by pointed instruments; (?) by the wadding of firearms; sometimes by the displacement of certain viscera; by the effect of violent contusions, by a fall, by a violent blow.”⁹ This account is evidently the result of minute observation and industrious research, is in the main accurate, and is given in reference to M. Portal’s great distinction of the diseases of nerves into those of “painful and convulsive stretchings of the

⁹ Les nerfs, ainsi que les parties dont ils tirent leur origine, peuvent être comprimés, endurcis, ramollis, gonflés, atteints d’inflammation, de suppuration, de gangrène; ils peuvent être contus, blessés, comprimés à leur origine, conjointement avec le cerveau, ou avec la moelle épinière, dans leur passage à travers les trous du crâne ou du canal vertébral et dans le reste de leur trajet, soit dans le tissu cellulaire, soit dans les viscères, et enfin dans toutes les parties du corps plus ou moins exposées aux engorgemens et aux compressions.

Les nerfs peuvent être comprimés par les tumeurs en général; par des vaisseaux trop dilatés; par des muscles trop violemment contractés, ou déplacés; par des os luxés, fracturés, atteints de quelque exostose; par des corps étrangers, des grains de plomb, des balles; par la pointe d’un instrument piquant; par des morceaux d’étoffe introduits dans l’intérieur; à la suite de plaies faites par des armes à feu; quelquefois par le déplacement de quelques viscères; par l’effet de fortes contusions; par une chute; par un corps violent.—*Anat. Méd.* vol. iv. p. 142.

medullary fibres, and into those of compression which render the nerves insensible.”¹

¹ Whether the terms “*tiraillemens douloureux, convulsifs*,” employed by M. Portal, have been properly rendered may be questionable. French writers frequently employ these terms without intending to convey the notion that the fibres are actually put upon the stretch, and I believe the expression in this instance means merely the combination of pain and spasm, implying no more than what ancient writers meant to convey, when they used the terms “*distensio*” and “*convulsio nervorum*,” or as we are in the habit of employing the simple phrase convulsions; neither mode of expression implying any speculative notion as to the actual condition of the nerve affected.

APPENDIX.

II. OF THE FUNCTIONS AND ATTRIBUTES, IN THEIR NATURAL AND DISEASED CONDITIONS, OF THE PNEUMOGASTRIC OR EIGHTH PAIR OF NERVES, AS ILLUSTRATIVE OF THE GENERAL PRINCIPLES OF THE PATHOLOGY OF NERVES.

IN the preceding Appendix I collected some of the numerous cases illustrative of the pathology of nerves, which, notwithstanding the assertion of Andral, that pathological anatomy is little rich in facts connected with their structural changes, I found somewhat profusely scattered over the extensive field of our medical records. From a comprehensive view of these I attempted also, by no hasty generalization, to deduce and illustrate those general principles, which the phenomena appeared to warrant, which might, at least, bind together otherwise detached and isolated facts and observations, might explain or reconcile apparently discordant, sometimes even contradictory statements, and might somewhat clear the path of future labourers in the same field of pathological inquiry.

In the investigation of that curious disease, the laryngismus stridulus, or crowing inspiration of infant children, in which I happened to be engaged, I found my course beset with such obstructions and difficulties, from the want of some established and recognised principles, to which I could refer, that I was driven to work out the subject for myself. The inquiry has employed much of the little leisure I could command; but if the results shall interest my readers as much as they have in-

terested myself, or shall induce others to prosecute the investigation of that intricate subject, the morbid disturbance of function in nerves for which an obvious and tangible cause can be assigned, my efforts will have been well bestowed, and my principal ends accomplished.

In adducing facts in support of these general principles, I studiously avoided the introduction of those numerous illustrations, which I might have derived from physiological experiments and pathological observations upon the par vagum, and its branches the laryngeal nerves. This I did, that the observations, I had to make upon injuries and diseases of nerves in general, might not be suspected of taint, or even mixed up with any peculiar views I might be supposed to entertain with regard to these particular nerves, connected, as they are, with a disease, with regard to which I had already published my opinions; and because it was my original purpose to embody in the essay on the laryngismus stridulus the facts connected with the pathological history of those nerves. As I proceeded, however, I found even this subdivision of my subject too copious and extensive to be treated in detached portions, and I have thought it better therefore to make it the subject of a second Appendix. I shall now confine my attention exclusively to the functions, injuries, and diseases of these important respiratory nerves in their connexion with the general principles of the pathology of nerves, which they are admirably calculated to illustrate.

General Distribution and Offices of the Par Vagum and its Branches.

If, as has been already stated, injurious impressions upon nerves manifest themselves in their effects upon the remote extremities of their filaments, and if similar effects are observed in all their branches, then, it must be obvious that any morbid influence exerted upon the par vagum above the origin of the superior laryngeal nerve, should exhibit itself, not only upon the sensitive lining and the closing muscles of the glottis, upon which principally that branch is distributed, but,

through the rest of the pneumogastric nerves, upon the œsophagus, stomach, bronchi, and lungs, and, through its recurrent branch, upon the trachea and opening muscles of the glottis; for upon all these parts the nerve, to omit many of its minuter subdivisions, is distributed.

That these parts derive their nervous energy from this common source, has been ascertained by those experiments upon the pneumogastric nerves, to which endless hecatombs of animals have been sacrificed, and which have been repeated *ad nauseam usque* for a vast variety of purposes; the results having been stated somewhat differently, according to the precise object which the experimenter had in view. So some have directed their attention to the influence of these nerves, especially the recurrent, upon the voice;¹ others to their effect upon the movements of the glottis;² others to their influence upon the secerning, digesting, or propelling power of the stomach, both in the performance of its natural function and in vomiting;³ a few to the effects upon the lungs, though the changes of these have been, more commonly, rather incidentally noticed than very minutely described;⁴ others to the influence upon the moving and propelling power of the bronchi and trachea, upon the sensibility and secretion of the lining membrane of the bronchial cells, the bronchi and the trachea.⁵

The result of such numerous and painful experiments has been to present to us a body of evidence upon the physiology of these nerves, more clear and convincing than upon that of any other nerves in the human body; and it may, perhaps, be neither useless nor altogether uninteresting, to give a brief sketch of the information we possess upon the subject of the distribution and office of their branches, beginning with the superior laryngeal nerve.

¹ Rufus of Ephesus, Galen, Martin, Haighton.

² Le Gallois, Wilson, Philip, Magendie, Bourdon.

³ Haighton, Cruikshank, Brodie, Broughton, Breschet, Edwards, Vavassour, Cruveilhier, Leuret, and Lassaigne.

⁴ Le Gallois, Dupuytren, Brachet.

⁵ Brachet.

Functions of the Superior Laryngeal Branch of the Par Vagum.

This, it is well known, divides into an external and an internal branch ; but with the latter of these only I am much interested. This internal branch supplies the closing muscles of the glottis, as has been proved by the dissections and observations of that indefatigable anatomist and physiologist, Magendie, who traced it "into the arytaenoid muscle, to which it sends a considerable branch," and "to the crico-thyroid muscle, to which it gives a filament less remarkable for its volume than its course."⁶ It supplies, therefore, those muscular bands which close effectually the glottis, and others which so elevate the cricoid, as, at the time of swallowing, to bring it under the edge of the thyroid cartilage. Having traced these nerves thus to the constrictor muscles of the glottis, he inferred that their office was to cause the closing of that chink during swallowing. This belief he verified by seeing the glottis close during that effort, and by the negative evidence derived from the division of this nerve and the consequent annihilation of its influence, when the constriction of the glottis was no longer complete during deglutition: "the edges of that aperture drew near to each other at their anterior part, but there remained a sensible space between their posterior extremities. The two arytaenoid cartilages did not afterwards apply themselves with accuracy to each other, as happens when the nerves of the larynx are entire."⁷ But Magendie says nothing of the dependence of the sensibility of the membrane of the glottis upon the same nerve, nor am I aware of any experiments directly upon that point. The affirmative, however, derives much support from the rest of the narrative of this experiment ; for having, by a division of the superior laryngeal nerve, deprived the closing muscles of the glottis of their contracting power, he extirpated the epiglottis; and after the wound in the neck had been allowed to heal, the dog swallowed generally with facility, though

⁶ Mém. sur l'usage de l'épiglotte dans la déglutition, p. 8.

⁷ Mém. p. 5.

sometimes he experienced a little distress, manifested by two or three efforts to cough. It seems probable that small fragments of food, or drops of liquid, must, under these circumstances, have occasionally dropped into the edge of the open glottis; but these excited no painful sensation, and the next expiration dislodged them. When, however, these passed the chink, narrow as it was, then, the sensibility of the lining membrane of the trachea, which derives its nervous energy from the recurrent, standing sentinel over the entrance to that part of the air tube, warned that canal and the lungs of their danger, and "two or three efforts to cough" dislodged the extraneous substance. A subsequent experiment of Magendie, in which he divided the recurrent nerves as well as the superior laryngeal, and then removed the epiglottis, affords indirect evidence upon the same point. As far as the movements of the glottis were concerned, that chink was in the same condition in this experiment as when he merely divided the superior laryngeal nerves; the rima glottidis could not but be open, and we are expressly told that "*la glotte restoit ouverte.*"^a But in the case of the division of all the laryngeal nerves, in consequence of the want of sensibility in that part of the lining membrane of the trachea supplied by the recurrent, extraneous substances were carried by inspiration or their gravity lower down the air tubes, (perhaps even into the bronchial cells,) and rendered it difficult for the animal to swallow either liquids or ultimately solids, without the occurrence of paroxysms of cough. The difference of the effects in these two instances does not seem to have excited the attention of Magendie, or of MM. les rapporteurs, Pinel et Percy, who have said nothing upon the subject; but, whilst it admits of the explanation I have offered, it illustrates the function of these nerves. The pneumogastric nerves, it will be recollected, still preserved their continuity and their office; the sensibility, therefore, of the bronchi, the bronchial cells, and the lungs, was unimpaired; and the irritation of these, impatient of the admission of such foreign substances, excited the violent cough for their extrusion.

^a Mém. p. 6.

Minute anatomy also ministers to our aid, in the explanation of the physiology of this nerve; and here I would express my obligation to Mr. Swan for the useful information I have derived from his recent valuable publication. The engravings, as well as descriptions, in that elaborate work amply bear me out in my interpretation of the different offices, respectively, of the superior and of the inferior laryngeal nerves; for whilst he describes the former as "giving filaments to the membrane connected with that covering the epiglottis, the glottis, the back of the pharynx, and the membrane between *the superior extremities* of the arytaenoid cartilages,"⁹ he represents the recurrent nerve as terminating in the muscles of the larynx, without proceeding to the lining membrane of the glottis.¹ Analogy also leads to the same conclusion; for whilst dissection has traced the filaments of the recurrent to the trachea and its membrane, the experiments of the physiologist have shown that its muscular power, and the sensibility of its interior lining, are dependent upon those filaments; and if the recurrent, therefore, thus endows the membrane of the trachea with sensibility, the probability is strong, almost to certainty, that the superior laryngeal, which is distributed "upon the membrane between the extremities of the arytaenoid cartilages and the glottis," is the source of that exquisite sensibility which the rima glottidis possesses.

Of the small Branches given off by the Par Vagum, in its descent towards the Thorax.

The nerve, then, after sending filaments of communication, in its course through the neck, to the lingual nerve, to the superior and inferior cardiac plexus, to the facial, and to the upper cervical nerves, with small filaments to contiguous parts, as the carotids, jugular veins, and thyroid gland, also sends one or two filaments, which, after communicating with the sympathetic, proceed to the upper and hinder part of the lung, and contribute to the formation of the pulmonary plexus.

⁹ Explan. of the Plates, p. xlvi. plate xvi. figs. 4, 5, 7.

¹ Ibid, fig. 6.

Into the functions, however, the due performance of which these filaments influence, it is not necessary for me to enter with any minuteness. Their connexion with the lingual nerve is to associate the respiratory organs with speech and deglutition; with the cardiac plexus to associate them with the heart's action; with the facial for the purpose of connecting them with the muscles of expression; with the three upper cervical nerves, that the respiratory function may be *partially* under the influence of volition; and with the sympathetic, that secretion may be insured.

Distribution and Offices of the Recurrent Nerves.

The next important branch, which is given off by the par vagum, is the recurrent within the thorax. This winds round the subclavian artery on the right side, the arch of the aorta upon the left. It has communications for associated actions with the pulmonary, the cardiac, and the œsophageal nerves; and endows with nervous energy the muscular fibres at the back of the trachea, the lining membrane of the air-tubes as high as the "membrane covering the posterior part of the cricoid cartilage,"² and ultimately "divides into branches, which terminate in the lateral crico-arytænoid, and the thyro-arytænoid muscles."³ The filaments of the recurrent which go to the trachea "communicate with others from the second and third cervical ganglia of the sympathetic, on the inferior thyroidal artery;"⁴ and, from what is known of the attributes of the ganglionic system of nerves, there can be little doubt that this association is for the purpose of investing the lining membrane of the trachea with a secerning power.

That muscular fibres exist at the back of the trachea is abundantly known; and Portal, whose attention has been much directed to the vocal organs, their functions, and diseases, has represented them as consisting of two layers, of which one is longitudinal, the other transverse in its direction; the former shortening, the latter contracting the area of that

² Swan on the Nerves. 4to. Ed. p. 50.

³ Ibid.

⁴ Ibid. p. 52.

canal.⁵ The existence, however, of the longitudinal band has been doubted by some, denied by others. Sir Charles Bell,⁶ in his interesting paper upon the human voice, says nothing of their existence, and probably doubts it; and Meckel expressly says, that "this muscular membrane is composed solely of transverse fibres."⁷ The latter writer, however, describes a fibrous tissue, which is equivalent in office to such muscular fibres, composed of longitudinal bands, not forming a continuous membrane but leaving a multitude of oblong spaces between them, surrounding the whole trachea, adhering intimately to the subjacent mucous membrane, and shortening, by their great elasticity, the trachea, after it has been elongated by the agency of other powers."⁸

The existence of transverse bands, then, at the back of the trachea, attached to the cartilaginous rings at a little distance from each of their extremities, and having for their office to contract the area of that canal, can scarcely be doubted. Sir Charles Bell has given a beautiful engraving of them as they appear in the horse, and has represented them as very distinct and powerful. But they are easily exhibited, even in the human subject, by merely separating with care the inner membrane of the trachea, when they become visible to the naked eye, and appear extremely distinct when inspected through a lens of no great magnifying power.

Like other muscular parts, these fibres are supplied with nervous energy; and the filaments which are distributed upon them may be readily traced from the recurrent on each side. Mr. Swan, indeed, says little of these filaments; but Sir Charles Bell, in his "Engravings" of the nerves, published about twenty years before his paper on the Voice, and having no reference, therefore, to his views as to the office to which these transverse bands minister, has delineated no less than four branches proceeding thus to the back of the trachea, which has been drawn to one side; and the number of these filaments from the recurrents has not been at all overrated by him.⁹

⁵ Anat Méd. vol. v. p. 36.

⁷ Manuel, vol. iii. p. 516.

⁹ Engr. of the Nerves, plate iii. *b b*.

⁶ Phil. Trans. 1832, p. 299.

⁸ Ibid. p. 513.

That these bands, therefore, transverse in their direction, "inserted into, and extending a line or two beyond the extremities of the cartilaginous rings of the trachea,"¹ endowed with nervous energy and consequent contractile power, must, during their contraction, diminish the size of the trachea is clear from their course, and was made the subject of direct experiment by Sir Charles Bell, who arrived at these results,—that "when a portion of the trachea is taken out, and every thing is dissected off but this muscle, the cartilages are preserved in their natural state; but the moment that the muscular fibres are cut across the cartilages fly open. This muscle, then, is opposed to the elasticity of the cartilages of the trachea. By its action it diminishes the calibre of the tube, and by its relaxation the canal widens, without the operation of an opponent muscle."²

This muscular apparatus, some have thought, has for its office to increase the force of the current of air for the purpose of influencing the intonation, or power of the voice; but Sir Charles Bell rejects this opinion of Portal, and thinks that its principal, if not exclusive, office is "to free the passage of the accumulated secretion, which, without this, would be drawn in, and gravitate towards the lung."³ The influence of these fibres upon the voice is scarcely within my province, and I may therefore leave the question between these two great physiologists as it stands. But, reasoning from analogy, the opinion of Sir Charles Bell appears the more probable, since in the horse, which has no voice, but has a very lengthened canal through which the bronchial secretion must pass, these fibrous bands are very strong. In the horse, therefore, they cannot be for the purpose of affecting the voice; and since in both they are similar in situation, direction, character, and influence, it is probable that their ultimate object is the same in both, namely, to expel the mucus from the trachea.

That such is the office of these transverse fibres has thus been inferred, with his usual ingenuity, by Sir Charles Bell,

¹ Meckel.

² Phil. Trans. 1832, p. 300.

³ Ibid. p. 301.

and is confirmed by observation as well as experiment; for whatever has a tendency to obstruct or diminish the agency of these fibrous bands, will cause an accumulation of mucus in the air-passages. So in instances where the cartilages are ossified, in which case the extremities of the rings, no longer elastic, cannot be made to approximate, "the consequence of this must be, that the mucus which is occasionally accumulated will not be so readily expelled by coughing, and the air will not be thrown out in so small a column, nor with so much momentum"⁴ But whatever impairs the functions of the nerves may produce the same effect, as in extreme degrees of exhaustion towards the fatal termination of acute maladies. If the heart be the *primum mobile*, the respiratory function is certainly the *ultimum moriens*. "When the sensibility is exhausted in the common spinal nerves, from the ebbing of life, the respiratory nerves on the neck and side of the chest are still capable of exciting the muscles to renewed vibrations; they are the last to die."⁵ At length, however, these become enfeebled also; and one of the earliest consequences of this is the sound of mucous rattle in the air-passages—the "death-rattle" of the vulgar. The transverse fibres at the back of the trachea lose their contractile power, accumulation is the consequence, and the patient breathing through the mucus, thus detained in the cells and bronchi, that peculiar sound is produced. There is probably also a form of catarrhus senilis which arises from a similar cause. In some instances of this disease, where there was no evidence of bronchitis or increase of secretion, but where there was constant rattle with occasional cough for the dislodgment of the mucus, but with little distress, I have suspected that the disease has been seated near the origin of the respiratory nerves. I have recently seen an interesting example of this. I had attended a wine-merchant in Chelsea, much addicted to indulgence in the commodity in which he traded, during several attacks of delirium tremens, from which he, however, recovered. At length he fell into pecuniary embarrassment, and even appeared in the Gazette. During the

⁴ Baillie's Morb. Anat. p. 59.

⁵ Bell on the Nervous System, p. 155.

excitement of these, to his sensitive mind, very painful proceedings, he bore up manfully; but scarcely had his affairs been arranged, when he manifested symptoms of general dropsy with an approach to jaundice. These were much subdued; but he became more and more enfeebled and emaciated, and ultimately sunk. For nearly three days, however, previously to his dissolution, his power of expectoration gradually declined; accumulation, therefore, took place in the bronchial tubes and cells, and he could be heard to breathe through mucus from one end of the room to the other; but although his breathing was evidently laborious, yet he assured me that he had no distress, and no cough. Like the dog with the pneumogastric nerves divided by Brachet, he seemed to have no desire to breathe better. The phlegm "came now and then into his mouth" without effort, and like the occasional regurgitation of food through the œsophagus; but although he was within a few hours of his death, he was reclining upon his sofa, his mind was unclouded, his conversation calm and collected, his articulation distinct and less feeble than could have been expected, and his senses entire. The connexion of these symptoms with his former attacks of delirium tremens justifies a strong suspicion (even if it does not warrant the conclusion) that there was in this case some effusion the consequence of previous excitement, and that this had probably taken place about the origin of the respiratory nerves. The absence of all distress distinguishes the case from that of mere dropsical effusion into the cavities of the pleura. I could not procure an opportunity of verifying these suspicions by dissection. M. Brachet, however, alludes to an unedited work of a friend of his at Lyons on a form of catarrh in old people, not unlike this case, and constantly fatal. In this catarrh the mucus produces only a feeble cough, and and its effects are insufficient for the expectoration of that mucus. The lungs are gorged; the deep colour of the lips and cheeks indicates a want of the due changes in the blood (*d'hématose*). A state of stupor announces the part which the brain takes in this malady. The respiration, at first stertorous, often wheezing, becomes rattling. The examination

of the body exhibits—1st, a gorged state and dark colour of the lungs; 2ndly, considerable accumulation of a mucus more or less frothy, and occupying the whole extent of the bronchial cavities; 3rdly, a serous infiltration, sufficiently abundant, about the medulla oblongata, the annular protuberance, and the corpora pyramidalia.⁶ Here the seat of mischief is in the head; but a division of the par vagum produces the same effect, as Brachet has conclusively proved by his experiments, of which it will be sufficient for my present purpose to advert to two out of a very interesting series.

He injected into the trachea of a dog about an ounce of tepid water. The dog coughed with violent efforts, became much agitated by it, and insensibly threw up, soon after, all the water that had been injected. The presence of the liquid had excited a more abundant secretion of mucus, which kept up the cough and the expectoration for many hours. At last the dog appeared quite well.⁷ The next day he repeated the experiment upon the same dog, with the same result. The same phenomena occurred; but in about ten minutes it appeared to have thrown out all the water, that had been injected. The pneumogastric nerves were then divided; the expectoration ceased immediately, the rattle became established, and at the end of two hours the dog died.⁸

It cannot be doubted that in these experiments the fibres at the back of the trachea must have been paralysed, as well as those of the bronchi, though it is to a palsied state of the latter that M. Brachet principally refers the effect: for we shall see, when considering another important attribute of this nerve, that the branches which supply the trachea, which anatomy has shown to be derived from the recurrent, were also paralysed in this experiment.

The explanation, thus offered by Sir Charles Bell, of the office to which the transverse bands of muscular fibres at the back of the trachea are subservient, supported, too, by pathological observations and physiological experiments, appears,

⁶ Brachet, *Recherches expérimentales sur les Fonctions du Système Nerveux Ganglionaire*, p. 167.

⁷ Exp. xlvi. p. 159.

⁸ Exp. xlix. p. 159.

then, to be well founded, and is satisfactory as far as it goes; but it does not contain the whole truth. By the agency of these fibres the mucus may be brought as far as the cricoid cartilage; but by what power is it further carried through the glottis, so that, mixing with the secretions from the eyes, nostrils, frontal sinuses, mouth, and pharynx, it may escape? According to Sir Charles Bell, the strong expiratory effort of a cough is required to effect it. "When the air is inspired, the trachea is wide, and the mucus is not urged downwards; when the air is expelled, the transverse muscle is in action, the calibre of the tube is diminished, the mucus occupies a larger portion of the canal, the air is sent forth with a greater impetus than that with which it is inhaled, and the consequence is gradual tendency of the sputa towards the top of the trachea. In the larynx the same principle holds; for as the opening of the glottis enlarges in inspiration, and is straitened in expiration, the sensible glottis, by inducing coughing, gets rid of its incumbrance."⁹ But the mucus is expelled as well by those who have no cough, as by those who have. At night, and in the horizontal posture, there is little difficulty, perhaps, in accounting for the escape of the secreted fluid. In infants, the trachea being small, a very moderate impulse of air from behind is sufficient for its expulsion, and hence their proverbially quiet slumbers; but after the larynx and trachea have attained their adult size, the most quiet sleepers breathe louder than children, or even than they themselves do in the day-time; and slight explosive expirations, like those which succeed to the act of swallowing, may be heard from time to time, which have probably for their office to expel the minute quantity of mucus, there accumulated, through the glottis. In the course of the day, however, a subsidiary agency is exerted—that of the muscles of deglutition. Those, who will take the trouble to analyse the phenomena attending swallowing, will perceive that the chest is filled previously to the attempt; that during the effort the trachea is considerably elongated, and contracted in its diameter; that at that moment the cricoid cartilage is

⁹ On the Organs of the Human Voice.—Phil. Trans. 1832, p. 301.

elevated more even in proportion than the rest of the larynx and trachea, its edge being brought completely under the corresponding edge of the thyroid cartilage; and that, immediately after swallowing, a slight explosive expiration takes place, which it is difficult to counteract by any effort of volition. It is even audible; and it will be found by experiment, that the attempt to draw in the breath previously to this very slight explosive expiration is attended with discomfiture. That this is intended to carry the mucus with celerity through the glottis can hardly be doubted. We see the elevation of the larynx, which must elongate the trachea; we can feel the diminution of area of the trachea; and Magendie observed with accuracy, and has recorded with fidelity, this very peculiar movement of the cricoid cartilage, for which I can trace no other purpose than that of throwing the mucus, thus brought to the edge of the glottis, into and perhaps through that chink. This movement, the posterior part of the ring being fixed whilst the anterior is carried upwards and inwards, resembles that of a hoop, which will strike the shin with force when an attempt is made to raise it from its horizontal position by pressure upon its edge with the foot; or that of a basin containing fluid, treading upon the edge of which will throw its contents to a considerable height upon the limb, whilst the edge of the vessel itself may also strike the shin. The cricoid cartilage is thus a sort of pail, which, filled from the trachea, empties its contents into or through the glottis, and performs an office somewhat analogous to those scoops or buckets, which, attached to a large wheel, help to deepen the river by drawing the earth from its bed, and, by the same revolution of the wheel, discharge their contents into an adjoining lighter for ballast or other purposes.

I believe, then, with all modern writers, that the muscularity of the bronchi carries the mucus of the air-cells into the trachea; with Dr. Baillie and Sir Charles Bell, that the contraction of this canal brings it to the cricoid cartilage, whose area is unsusceptible of diminution; but I believe, further, that it is by the movement of the anterior edge of the plane of this cartilage upwards, that the mucus is brought to the

glottis, and that then a slight explosive expiratory effort carries it with rapidity through that chink.

But the par vagum, through its branch the recurrent, also endows the lining membrane of the trachea with sensibility. Sir Charles Bell has alluded to some coarse experiments, made by others, by which this was determined. "The trachea of a large dog being opened, it was attempted to thrust different substances into it during inspiration, but these were always sent out with impetus, and could not be retained." Sir Charles, indeed, only uses the fact as an illustration of the action of the muscular fibres; but it was the sensitiveness of the membrane that sounded the alarm, and removed the danger by the "impetus," by which was probably meant violent cough; for such is the common, if not universal, result of the introduction of foreign bodies into the trachea. M. Brachet has contrived and executed a beautiful series of experiments, which present us with a body of evidence, both positive and negative, upon this point, which is quite conclusive. In a dog of small size he excised a portion of the two pneumogastric nerves, and immediately afterwards he removed an oval portion of the trachea; respiration was continued with regularity; he then introduced a small ball of orris root (*d'iris*) attached to a thread; the respiration was impeded by it, and the ball ascended and descended in the alternate acts of expiration and inspiration; *but the dog manifested no sign of any disagreeable sensation*. He then removed the ball that he might apply to the opening in the trachea a bottle of muriatic acid gas, which he held there uncorked for several minutes, and allowed a few drops of the acid to fall into the interior of the trachea. He did the same with acetic acid, but obtained no sign of sensation.¹ Then, *without dividing the pneumogastric nerves*, he made a similar oblong opening in the trachea of a dog of about the same size. A few drops of blood fell into the trachea, and by exciting cough, proved that the mucous membrane had retained its sensibility entire. The ball of orris root excited vehement efforts to cough, which pushed it violently towards the larynx. The

¹ Brachet, op. cit. Exp. xlvi. p. 156.

muriatic acid produced violent fits of coughing, which obliged him to suspend his experiments. The cough became more moderate, and often expelled some flocculi of mucus; the dog continued oppressed. Again he brought the muriatic acid to the aperture in the trachea, and the cough recommenced. He then made an incision on both sides of the throat, and divided the eighth pair; the cough ceased suddenly, the respiration became all at once rattling, (*râleuse*,) and in less than an hour the dog expired, without expectorating any thing.² These facts interpret themselves, and conclusively establish the dependence of the trachea for its sensibility upon the eighth pair; and as the branch of the par vagum, which supplies the lining membrane of the trachea, is the recurrent, the statement may be still further limited to the affirmation that the trachea derives its sensibility from the recurrent nerves.

But there is another important office to which the recurrent branches of the pneumogastric nerves minister, namely, the movements of the glottis. These nerves, according to Magendie, supply exclusively the opening muscles of the glottis, in which, according also to Mr. Swan, they terminate. There has been, however, some dissonance of opinion upon this point. Magendie, in his memoir upon the use of the epiglottis in deglutition, alleges that he has never been able to trace a single filament of the recurrent either to the cryco-thyreoid, or to the arytænoid muscles;³ but that the muscles, upon which its branches are distributed, are exclusively the posterior and lateral crico-arytænoid and the thyreo-arytænoid muscles; in other words, the recurrent supplies the opening, to the exclusion of the closing muscles of the glottis. This MM. Pinel and Percy, who reported to the class of the Institute upon the subject of that interesting memoir, confirm by their own observations and dissections;⁴ and, at the end of twenty years, Magendie still enforces the same statement in his Ele-

² Ibid. Ex. xlv. p. 157.

³ Mémoire sur l'Usage de l'Epiglote, 1813, p. 8.

⁴ Rapport sur le Mémoire &c. p. 24.

ments.⁵ Meckel, however, doubts this fact, and thinks that the superior and inferior laryngeal nerves supply indiscriminately both sets of muscles; and Mr. Swan, whilst he has described some of the branches of the superior laryngeal nerve, as piercing the closing muscles, (though he is unable to determine whether any of them terminate in those muscles,) distinctly also both describes, and delineates certain filaments from the recurrent, which terminate in the oblique and transverse arytnæoid muscles. Magendie's views, however, are more generally adopted by modern anatomists and physiologists, including Cloquet, (himself a host,) Le Gallois, and Bourdon; but Meckel has in his support the high authorities of Rudolphi, Andersch, Soemerring, and Swan. It is not easy to reconcile these conflicting statements of anatomists equally entitled to our confidence; but as I place much reliance upon the minute accuracy of Mr. Swan, and as his dissections (which he has favoured me with an opportunity of seeing) seem to bear out his assertion, I am bound to place reliance upon positive, rather than upon negative facts. It may be conceded, then, that some filaments of the recurrent may be traced to the closing muscles of the glottis; and it is not improbable that these, as well as the anastomosing branches of the superior laryngeal with the recurrent, are intended for those rapid and delicate associated actions connected with the voice, by which the chordæ vocales are rendered more or less tense, and their vibrating portions longer or shorter; whilst the main branches, described by Mr. Swan as terminating in the opening muscles of the glottis, are for the purposes of those grosser movements of the rima glottidis connected with respiration and deglutition. At all events, the main facts, founded upon physiological experiments, will remain; for, by that negation of nervous influence which a division of the recurrents implies, not only is the voice destroyed, (as was well known to Rufus, Galen, and succeeding anatomists,) but the sides of the glottis are made to approach to each other. In those smaller and *very young* animals, in which the rima glottidis is at once naturally short and narrow,

⁵ Précis, vol. i. 1833, p. 288.

the opening muscles being paralysed, the glottis is closed, and asphyxia is the result; but if the animal be older, or if the glottis be of such a form, as that its sides cannot be made to touch, then, if the par vagum "be divided before the inferior laryngeal nerve is sent off, or this nerve itself is divided, great difficulty of breathing, *with a croaking noise*, immediately follows;" arising, as M. le Gallois has shown, "from the opening of the glottis becoming much narrowed, as soon as the nerve is divided."⁶

Many facts combine to prove that the natural state of the glottis, when uninfluenced by muscular contraction, is that of openness. In the still-born infant, in whom previous to birth there can have been no alternate action of its opening and closing muscles, the glottis is always open. In the course of above twenty years' experience in this metropolis, I have never met with an instance in which I could not readily fill the lungs of a still-born infant by simply blowing into its mouth, taking the precaution to close the nostrils and to press upon the cricoid cartilage; and in the experiment of Magendie, in which he divided the four laryngeal nerves, the glottis remained permanently open even during the act of deglutition, which, under other circumstances, effectually closes that chink. But although this is unquestionably its condition when in a state of inactivity, yet the statement that it opens in inspiration and becomes closed in expiration, has acquired all but universal belief. This alternate opening and closing of the glottis, corresponding with the alternate movements of respiration, was satisfactorily proved by ocular demonstration in the experiments of Le Gallois; who, in a rabbit about two months old separated the larynx from its connexion with the os hyoides, without wounding the laryngeal nerves or the par vagum, and pulled it forwards so as to expose to view the glottis, which was sensibly open during inspiration, when it became distinctly roundish, or rather somewhat oval;⁷ and he adds that in other rabbits of the same age, the arytaenoid cartilages and the glottis had move-

⁶ Philip's Exp. Inquiry, 2nd edit, p. 120.

⁷ Expériences sur le Principe de la Vie, p. 196.

ments corresponding with those of respiration. "At each inspiration the glottis was enlarged, and assumed a roundish form; but during expiration, it became contracted by the approach towards each other, and towards the thyroid cartilage, of the arytaenoid cartilages, and so on in succession."⁸ Sir Charles Bell adds his testimony to that of Le Gallois, and ascribes to the latter the first notice of the fact, that "the chink of the glottis opens at each inspiration,⁹ and on another occasion, he says, "in consequence of wounds of the throat, I had repeated occasions to witness the motions of the glottis in man, both during simple breathing and in speaking. On every inspiration, the glottis is dilated. Upon asking the patient to speak, and encouraging him, when no sound proceeded, by saying that I could understand him by the motion of his lips, I have seen that, in the attempt at utterance, the glottis moved as well as the lips. Although these occasions be too painful to admit of protracted experiment, I could not omit observing that there is a motion of the glottis in correspondence with the efforts of the other organs of voice."¹ Magendie also asserts, that "the glottis is very far from being inactive in the movements of expiration and inspiration; it opens and shuts itself alternately."² Notwithstanding, however, the high authority upon which these statements rest, I am much inclined to the opinion that, in ordinary and easy respiration, the movements of the glottis, like those of the nostrils, are so inconsiderable as to be scarcely perceptible. We are certainly unconscious of its movements, although, upon many other occasions, we can recognize its closed condition in ourselves; at all events, the experiments of the physiologist, and the cut throat of the suicide present us with not the most favourable opportunities of investigating the phenomena of natural unembarrassed respiration. The experiments of Le Gallois are conclusive as to the movements of the glottis, when the larynx has been subjected to such

⁸ *Expériences sur le Principe de la Vie*, p. 197.

⁹ *On the Nervous System*, p. 118.

¹ *On the Organs of the Human Voice*, Ph. Tr. 1832, p. 305.

² *Précis Elém.* vol. ii. p. 336.

violence as that of dividing it from its attachment to the os hyoides, and dragging it forwards and to one side, so as to bring the chink into view ; but whilst these experiments have been universally quoted, and his general statement adopted, the restrictions and limitations of his general proposition have been much overlooked ; for he expressly says, “ that these movements of the glottis *do not take place*, or at least are not well-marked, unless the respiration is somewhat embarrassed ; and when that function is free, the glottis remains rather largely open, and *without much variation*.”³ Even the observation of Sir Charles Bell scarcely justifies the inference that there is considerable movement of the glottis in ordinary respiration ; for it was “ in the attempt at utterance the glottis moved as well as the lips,” and “ there was a motion of the glottis in correspondence with the efforts of the other organs of voice.” My able colleague, Mr. Mayo, more completely corroborates my view upon the subject, for in an analogous observation of the cut-throat of “ an attempted suicide,” he expressly alleges, as the result of inspection, that, “ during gentle respiration, the aperture of the glottis is seen to be *considerably expanded and motionless*. It does not, however, continue motionless if the patient become agitated and the breathing disturbed. In the latter case, at each expiration the aperture is considerably narrowed.”⁴ It appears from these observations, therefore, that “ when a patient is tranquil and breathes gently, the rima glottidis forms a triangular opening ; but when he attempts to vocalize, the vocal ligaments are brought nearly parallel, and the aperture of the rima glottidis becomes narrower and linear.”⁵ Such being the case when an incision has been made into the larynx so as to expose it to view, we may safely conclude that there will be as little extent of movement in ordinary respiration, when the

³ “ Il faut observer que ces mouvemens de la glotte n'ont lieu, ou du moins ne sont bien marqués que quand la respiration est un peu gênée. Lorsqu'elle est libre la glotte demeure assez largement ouverte sans varier beaucoup,”—Expériences, p. 197.

⁴ Med. Gazette, vol. x. p. 159.

⁵ Outlines of Human Physiology, by Herbert Mayo, F. R. S.

respiratory tube has received no injury. In simple unembarrassed breathing, then, the glottis remains open; "in vocalization, the aperture of the glottis is reduced to a narrow longitudinal fissure;"⁶ when the patient is agitated or the breathing disturbed by any cause, the sphere of movement is much increased; and during great exertion—in fright, in crying and sobbing, in cough, and in swallowing—it is often completely closed. Bearing in mind, then, the general principle with reference to which I have stated these facts, we are to look for the effects of injurious impressions upon the recurrent nerves in some disordered condition of the fibrous bands at the back of the trachea, in the sensibility of its lining membrane, and in the movements of the muscles of the glottis.

Offices of the Pulmonary Branches of the Par Vagus.

The next set of important nerves, which are given off by the par vagum, are those which form the pulmonic plexus. These penetrate the substance of the lungs, and supplying principally the bronchial cells, and perhaps the air cells of the lungs themselves, endow them with that peculiar sensibility which conveys to the sensorium a sense of the necessity of breathing and painful sensations from its distressed condition. This is stated in general terms by almost all physiologists, especially by those upon the continent, and was made the subject of direct experiment, amongst others, by M. Brachet. He divided the two pneumogastric nerves in a small dog, and immediately plunged its muzzle into tepid water, so as altogether to intercept the introduction of air. The animal did not attempt to raise its head, and it died asphyxiated, after some slight movements not essentially connected with the efforts of respiration.⁷ He then placed the muzzle of another dog equally under water, but without dividing the pneumogastric nerves. It required great force to keep the animal there, on account of its inces-

⁶ Mayo.

⁷ Exp. xxxiv.

sant attempts to escape and to make every effort to breathe freely. The asphyxia was not produced without considerable trouble, and without occasioning convulsive movements.⁸ He placed a third dog in a pneumatic bell, filled with atmospheric air: at first it breathed freely; soon, however, the respiration became more laboured and hurried, the animal raised its head, expanded its nostrils, and opened widely its mouth. It was asphyxiated with all the symptoms which usually attend that kind of death.⁹ Having divided the par vagum on each side and opened the trachea, he placed a fourth dog, in a similar way, under a bell filled with atmospheric air: it performed the movements of respiration as if it had not been thus shut up, and, after forty-six minutes, he died without a struggle, without expanding his nostrils, without opening his mouth.¹ After a section of the eighth pair, and the introduction of a canula into the trachea, he placed a fifth dog under a bell filled with nitrogen gas: the animal executed the same respiratory movements as the preceding dog, but at the end of three minutes it was asphyxiated.² Suffocation was equally the result in these cases, whether the nerves were cut or not. When, however, the pneumogastrics were still undivided, the animal's distress was great; when their communication with the sensorium was destroyed, it appeared to suffer nothing; and the result of simple division of the nerves, without opening the trachea for the admission of air, was similar; for notwithstanding the extremely laborious breathing, the animal experienced no suffering, the chest expanded, and then expelled the air with difficulty—with effort; but the dog did not seek to respire better: he was not in the least agitated by that restlessness which is produced by simply stopping the air-passages, as he ascertained in another dog whose pneumogastrics were uninjured.”³ In this we may trace a beneficent provision to alleviate the sufferings of approaching dissolution. In the state of extreme exhaustion which precedes death, after all consciousness and power of voluntary movement are annihilated, when the surface is cold

⁸ Exp. xxxv.⁹ Exp. xxxvi.¹ Exp. xxxvii.² Exp. xxxviii.³ Brachet, *op. cit.* p. 133.

and clammy, and the pulse no longer perceptible, the breathing continues though it is laborious; the muscular fibres of the bronchi and back of the trachea lose their contractile power; the "death-rattle" takes place; but the same condition which deprives these parts of moving and expelling power, also impairs their sensibility; and although the patient is said to "struggle," and often "to die hard," yet there is strong reason to think that the suffering is inconsiderable.⁴ Even the sensibility of the pharynx and glottis is commonly lost in these cases: spirit may be poured into the mouth, but it hangs about the pharynx and entrance to the windpipe; the air passes through it, both in inspiration and expiration, and yet neither distress nor strangling cough occurs: and as the glottis derives its sensibility from a part of the pneumogastric nerve, which is nearer to the sensorium commune than that which supplies the trachea and lungs, it can be no strained inference to conclude that these latter parts of the respiratory apparatus must also have their sensibility impaired. In the bronchi, therefore, and in the air-cells, we may expect to discover the results of injurious impressions upon the trunk of the par vagum.

Of the Cardiac Branches of the Par Vagus.

The heart also derives nerves from the par vagum, which contributes to the formation of the cardiac plexuses; but this great centre of the circulating system is, upon the whole, more under the influence of the ganglionic than of the cerebral nerves. Great and sudden violence, however, done to the par vagum will temporarily influence the heart's action, considerable irregularity having been frequently observed upon divi-

⁴ A highly-gifted and intellectual professional friend, who had suffered for years under a lingering ailment which had reduced him almost to the condition of an "*anatomie vivante*," towards the termination of his ailment was thought to have breathed his last. He, however, rallied for a few days, and during this brief respite, conscious of his approaching dissolution, he often spoke of his condition at the moment alluded to, as one equivalent to death. He now knew, he said, what it was to die, for "death gripped me last Thursday." He spoke of it, however, without horror or feeling of agony.

sion of the eighth pair. This probably arises from the injury to those filaments which are intended for the associated actions of these two important organs or systems. For the independent action of the central organ of circulation, the influence of the ganglionic system may possibly be sufficient. As the function, therefore, of the heart depends so much more upon other, than upon the pneumogastric nerves, it is not in that organ that we are to seek for the more marked symptoms of a morbid condition of the par vagum.

*Of those Branches of the Par Vagus which supply the
Œsophagus and Stomach.*

The last parts, to which it is necessary to advert as deriving their supply of nervous energy from the branches of the par vagum, are the œsophagus and stomach; and the account I have to give upon this part of the subject need not detain me long. The obvious distribution of the nerve upon those parts might suffice; but there are not wanting abundance of experiments to establish by evidence, both positive and negative, the influence of the pneumogastric nerves upon these organs. So it has been found that, upon irritating with a scalpel, or touching with alcohol the œsophageal plexus of the pneumogastric nerves, the peristaltic action of the œsophagus and stomach was invariably excited; and it is equally ascertained that, upon a division of this plexus, such peristaltic movements cease.⁵ The experiment of Le Gallois upon the guinea-pig was equally conclusive upon the point. He divided the par vagum on the right side; in proportion as the animal ate, the belly increased in size till it equalled in length the whole body, and it could no longer walk. It died in four days and five hours, and, according to Le Gallois, probably of distention, which interfered with respiration. The stomach after death was found to fill the belly; but the food was in the same state as when taken. It is obvious that, in this case, the muscular coat of the stomach was paralysed, and dis-

⁵ Breschet and Edwards, in Arch. Gén. de Méd. 1825. Tiedemann and Gmelin, Recherches sur la Digestion, sect. lii. p. 374.

tention was the consequence ; and the results of the experiments of Valsalva and Baglivi coincide with those of Dr. Philip and Mr. Hastings in showing, that the same thing happens in the lower part of the œsophagus, which, after the division of the pneumogastric nerves, “is also found to contain food, and is often very much distended.”⁶

But the par vagum is, also, the nerve of that peculiar sensibility of the stomach which conveys to the sensorium the sensations of hunger and of satiety. Some have doubted whether this can be the fact, seeing that the animal continues to eat after the division of the nerves, which, according to some, proves the animal to have appetite. But more intellectual animals than dogs eat when they have little appetite and less hunger ; nor do they always know when they have had enough. The interesting series of experiments upon this point by M. Brachet conclusively establish the dependance of these sensations upon the pneumogastric nerves. In a dog which had fasted for twenty-four hours, when he seemed to be devoured with hunger, M. Brachet divided the eighth pair below the origin of the recurrents. The animal, unconfined and left to itself, no longer sought to eat ; the respiration was free, although a little slow. He then gave it food cut into small morsels ; it ate the food, but without seeking it. He continued to present it to satiety, but the dog did not cease to eat until he was unable to swallow more on account of the fulness of the œsophagus.⁷ Two other animals were kept from food for eighteen hours ; they searched around without ceasing ; they raised their heads and uttered such cries as marked their hunger. A portion of both the pneumogastric nerves was then removed, adopting the precaution of making an opening into the trachea. Their trough was then filled with crumb of bread, a kind of aliment which they had previously eaten with pleasure ; they however lay down without taking any account of it. He then put it directly under their nose ; they ate, but with a sort of indifference. Food was then placed at a little distance, but they budged not, although

⁶ Experimental Inquiry, 2nd edit, 1818, p. 123, Exp. xlv.

⁷ Exp. li.

it was only six inches from them. He gave them successively and in very small portions, as much bread as they would take, or more than they could eat; for they did not stop until deglutition was no longer practicable. They ate because the food was before them and was savory to the palate, but hunger had little influence with them, as they no longer sought food after the division of the pneumogastric nerves.⁸ These animals, then, perceived not hunger: on presenting food to them they ate, it was true, but they had no sensation in the stomach of fulness or satiety. The stomach being full, they continued to eat, and filled also the œsophagus.⁹

Morbid Impressions upon the Par Vagus produce their effects upon its remote Branches.

Having now traced the principal distribution and offices of the branches of the par vagum, we shall be prepared to consider its injuries and diseases, the signs and consequences of which are to be sought in the remote distribution of its filaments; and, as it is another general principle connected with the pathology of the nerves that all the branches of a given trunk suffer a similar disturbance of function from the agency of the same cause, it will not be very difficult to determine in what part of the nerve, or of its branches, the morbid impression is made. So, if the seat of mischief be at its root in the medulla oblongata, we are to expect analogous disturbance in all those parts and organs which I have adverted to; if below the part where the superior laryngeal nerve is given off, the closing muscles and the sensitive lining membrane of the glottis will retain their powers unimpaired, but all the parts below will suffer; if the trunk of the par vagum be affected between the superior and the recurrent laryngeal nerves, all the parts which derive their supply from the recurrent will be influenced, as well as the lungs, œsophagus, and stomach; if

⁸ Exp. liii.

⁹ Valsalva thought that this fulness of the œsophagus was from the food being arrested in that canal, and not reaching the stomach; and Baglivi merely mentions the fact that the œsophagus, after the division of the eighth pair, was filled throughout its whole length by food previously taken.—Valsalva, by Morgagni, Ep. xiii. art. 30; Baglivi, op. omn. Dissert. 8, p. 676, Lugdun. 1710.

below the recurrent, the parts supplied by the pulmonic and the œsophageal plexus, and by the corda ventriculi will be affected; if the recurrent itself be affected, the lungs, œsophagus, and stomach may escape, but we shall trace its influence in the muscular fibres at the back of the trachea, its sensitive lining, and the opening muscles of the glottis; and if the recurrent be affected high up in its course by the side of the trachea, near or opposite to the cricoid cartilage, the transverse bands behind the trachea will be in their natural state, the lining membrane will retain its sensibility, but the opening muscles of the glottis will have their function disturbed.

Causes and Effects of Excitement of the Par Vagus.

The disturbance of function thus observed in a greater or smaller number of parts, according to the seat of the morbid impression, will be similar in kind in all, though it may vary in degree; and it has been seen that the two principal forms of diseased condition of nerves are that of excitement, and that of enfeebled power. The effects of excitement of the par vagum are, perhaps, not so well ascertained as those of enfeebled energy; but there are facts enough to be collected upon the subject to interest an inquirer, and to illustrate the subject.

At the outset of my observations on the pathology of nerves, amongst the principal causes of excitement of nerves I enumerated sudden mechanical impulse, vascular congestion or excitement, inflammation, structural disease, and functional disorder; and it may be not uninteresting to inquire how far the influence of each of these causes may be traced in the morbid affections of the par vagum. Such is the situation of this nerve, deep-seated at the upper part of the throat, behind the great vessels of the neck below, and close to the subclavian artery upon one side—to the aorta upon the other, that it is out of the reach of the ordinary accidents of life, without such injury to those vessels as would involve immediate destruction; but it is not beyond the reach of the instruments of torture of the physiologist, or of the occasional accidents of surgery. So Cruveilhier irritated mechanically these nerves in

the neck, to ascertain their action on digestion and respiration; ¹ and we have seen that Breschet and Edwards irritated with pointed instruments, and with spirits of wine, the œsophageal plexus. In the former experiment the irritation excited a convulsive cough, in the latter it occasioned peristaltic movement of the œsophagus and stomach; nearly the same effects as would be produced by irritating the extremities of the same nerves. In this way, too, I would explain an occurrence which took place in the case, in which one of my earliest professional teachers first essayed to tie the carotid artery. With his usual adroitness he succeeded in applying two ligatures upon the vessel at about the distance of half an inch from each other, leaving the artery undivided. "As soon as the threads were tied, all pulsation in the tumour ceased; and the operation being concluded, and the wound superficially dressed, the patient rose from the chair in which she sat during the operation, and was immediately seized with a fit of coughing, which it was thought would have terminated her existence. This seemed to arise from an accumulation of mucus in the trachea, which she could not expel; it continued about an hour, when she became more tranquil." Such are the facts stated upon the very highest authority; and it can detract nothing from the deservedly exalted reputation of this distinguished operator, if I venture to express my doubts of the sufficiency of this explanation, which several considerations lead me to think not altogether satisfactory. No cause is assigned for the collection of mucus, nor is evidence offered of its existence. If it had been there, it could not have required a fit of coughing of half an hour's duration to expel it; and the cough only occurred upon a sudden change of posture. During the operation and subsequent dressing of the wound, the patient must have sat with the head and neck extended very much backwards, to give sufficient space for the operation; she then suddenly assumed the erect posture, the head resuming its natural position. The return of the

¹ Jolly, L. ii. de la Nouvelle Bibliothèque Médicale, 1828. Quoted also by Montault in Journ. Un. et hebdom. de Méd. et Chir. Tome ii. p. 73.

trachea to its ordinary situation and direction would have been rather calculated to prevent, than to produce a strangling cough from mucus, even if that mucus had been there in great quantity ; but it does not appear that any was, after all, coughed up by these vehement efforts. These difficulties have led me to seek further for an explanation of this cough ; and the key afforded by the experiment of Cruveilhier, together with the beautiful engravings with which Sir Astley Cooper's communication has been embellished and illustrated, opens a view of the subject which, in my estimation, is infinitely more satisfactory. These engravings show that the ligatures must have been placed directly between the par vagum upon the one side, and the recurrent upon the other ; but, of course, nearer to the former, which is rather behind, in the same sheath, and generally in contact with the artery ; and it is more than probable that the sudden change of posture brought the undivided artery, now irregular in form from the two ligatures and knots upon its surface, into a different situation, so as to come in direct contact with, and in the sudden movement of the neck to rasp, as it were, and mechanically irritate one or both of those very important nerves, with the excitement of which Cruveilhier's experiment proves the occurrence of convulsive cough to be essentially connected. The effect, it will be observed, is the same as that which would arise from irritating the part upon which the remote branches of the same nerve are distributed.

Some have considered stretching to be a form of mechanical impulse which excites a nerve to the production of pain or convulsive movement ; but I have already expressed my doubts upon this point. An experiment of Mr. Hastings upon the rabbit, gives countenance to those doubts, as far as the par vagum is concerned ; for, “ after having raised these nerves upon a probe, and then replaced them, the digestive process went on as usual, and the food was found in the same state as in a healthy rabbit,” and “ the lungs continued perfectly to perform their office, and were found of a healthy

appearance after death." But I further stated my belief, founded upon observations and experiments of Mr. Phillips and others, that, where nerves were greatly stretched, paralysis was more frequently the result, the injurious impression resolving itself into the more general principle of pressure. Such appears to have been the case in an operation, the details of which are extremely interesting, performed by a most eminent practical surgeon upon the subclavian artery of the right side, where it emerges from the innominata. In the progress of this operation "the internal jugular vein was removed beyond the reach of the knife, by pressing it outwards with a flat silver instrument, not unlike a powder knife, bent at the point. When the sheath of the carotid artery was divided, the eighth pair of nerves became visible; it lay deep, and to the outside, nearer to the carotid, as they descend towards the thorax.".... "An instrument similar to that above described, but of larger dimensions, and greater curvature, was now employed to protect this nerve, together with the internal jugular vein;" and during this part of the operation "the breathing had become more laboured, and he complained much of an oppression at his heart." Had the silver instrument thus applied *irritated* the par vagum, cough, as in the experiment of Cruveilhier and during Sir Astley Cooper's operation, would have been the result; but the pushing to one side, necessarily involving considerable stretching with pressure, produced that distress, which compression of the par vagum from any cause notoriously occasions.

It has been commonly believed, and may, perhaps, be true, that vascular congestion of the neurilema, or of parts immediately contiguous to a nerve may occasion excitement, with exaltation of function of that nerve. It is not always easy, however, to define the boundaries between this state and that of actual inflammation, which run into each other by insensible degrees. Bichat has observed, that nerves whose neurilema remains perfect and uncontaminated with disease, may be bathed, almost with impunity, in pus or even in the sanies of cancer; but the best authorities upon these subjects agree

that nerves, surrounded by parts undergoing inflammation, are apt to partake of the contiguous disease.²

Where inflammation has been traced in nerves, the symptoms have, I believe, been always those of excitement, unless the surrounding thickening has so compressed the nervous filaments as to destroy their function, or unless *ramollissement* has been the consequence; in which latter case, the organ itself being destroyed, its function must also of necessity be annihilated. The symptoms, indeed, are the same as those from pricking or other mechanical excitement of the trunk of a nerve. Now it has been already seen that such mechanical irritation of the par vagum produces cough of a convulsive character; and the same thing happens when the nerve is inflamed. So, Autenrieth found the eighth pair and the cardiac nerves inflamed in individuals who had died of spasmodic cough, which refused to yield to any remedies. M. Breschet, in the examination of a great number of bodies of individuals who had had the whooping cough, traced a more yellow colour than usual of the pneumogastric nerves. M. Gendrin saw a convulsive cough supervene in a man in whom the nerves of the eighth pair had been denuded by a deep-seated abscess; and in the case already quoted of operation for carotid aneurism, by Sir Astley Cooper, a similar connexion was observed. On the sixth day after the operation, she had difficulty in swallowing fluids, and she had a troublesome cough. On the following day, a violent fit of coughing produced a slight discharge of venous blood from the wound; on the tenth day, she was incapable of swallowing solids; on the twelfth day, her cough is represented as "sometimes very violent;" on the eighteenth day, "she complained of a great difficulty in swallowing, and of a most *distressing cough, after the fits of which she hooped violently*;" on the twenty-first day from the operation, she was unable to swallow even her saliva, which constantly dribbled from her mouth; and every attempt at

² Thomson's Lectures on Inflammation, p. 153; Delpech, art. Cancer, in Diction. des Sciences Médicales; Swan on Diseases of Nerves, p. 57, also p. 65; Descot sur les Affections Locales des Nerfs, p. 199; Bell's Operative Surgery, vol. ii. p. 330.

deglutition produced *a violent cough*. She died on the twenty-second day. There was considerable inflammation, the swelling from which had so obstructed the pharynx, "that it would not easily admit of a bougie of the size of a goose-quill;" but the change, which, in my estimation and with reference to my immediate subject, was at once the most interesting and important, was suppurative inflammation of the aneurismal sac. "Around the clot of blood which it contained there was a considerable quantity of pus," and the "*inflammation extended on the outside of the sac along the par vagum, nearly to the basis of the skull.*"³

It is well known that the effects of sudden mechanical impulse are the same as those of inflammation; and that inflammation is very apt to take place in a nerve where surrounding parts are inflamed. There can be little doubt, therefore, seeing that in this case the par vagum was surrounded by parts in a state of diffuse suppurative inflammation, and that the symptoms were the same as those which we have seen to arise from mechanical irritation of the same nerve, that the pneumogastric had in reality partaken of the surrounding diseased condition.

Of structural diseases of the par vagum, I have been able to collect little that is satisfactory. Mr. Swan has, indeed, devoted a chapter to the subject, but his account is in some respects confused from not having distinguished between the phenomena of excitement of this nerve, as contra-distinguished from those of enfeebled energy. Thus, in the very interesting example which he has detailed of the injurious effects of colchicum, he has ascribed "the craving for food, and the want of a sensation of fulness after eating ever so much," to the *same condition* of the nerves, which he thinks had lost their sensitive qualities; yet the first of these symptoms appears to betray an excess, the latter a deficiency of sensibility. It may be, however, that this martyr to the gout may have eaten rather to gratify his palate than to satisfy his legitimate appetite, as occurred in the animals in which Brachet, Mr. Hastings, and others had divided the pneumogastric nerves;

³ Medico-Chirurgical Transactions, vol. i. p. 8.

for these animals continued to eat food, when placed immediately under their nose, until the stomach was full, and even the œsophagus distended. Upon what texture of the stomach the influence of colchicum is exerted has not yet been satisfactorily ascertained ; but that it impairs, and even ultimately annihilates the function of that organ, is well known. One of the friends of my youth, a merchant in the city, fell a victim to its continued employment, in the form of the *eau médicinale*. His stomach gave way suddenly, so that he rejected by vomiting every thing he took, and died of inanition within a fortnight after the first occurrence of this formidable symptom, which nothing that could be suggested by his professional attendant in the country would check. Now, the function of an organ being long and essentially impaired, the nerves supplying such organ become atrophied, as has been repeatedly observed in the optic nerves of blind people.⁴ It was probably the same in the instance so circumstantially related by Mr. Swan. The texture upon which the colchicum exercised its first impression may *possibly* have been the ultimate filaments or pulpy extremities of the nerves of the stomach ; but the organ had its function impaired for seven years, and atrophy of the trunks of the nerves seems to have been the result ; at least their “flabby state, like that of nerves removed from a putrid body, after having been soaked in water,” together with their diminution in size, bears a striking resemblance to the “*atrophie*” of continental writers. This explanation, moreover, derives additional support from another fact, noticed by Mr. Swan, that “in dissecting two (subjects) destroyed by consumption, the *left lungs were diseased* in a much greater degree than the right ; both trunks of the par vagum were smaller than usual, and especially when compared with those of a subject destroyed by empyema, and *the left trunk was smaller than the right* ;” affording thus strong evidence that the diminution in the size of the nerve was consequent upon, because proportionate to, the gradually increasing inutility of the organ which it supplied. The argument *e converso*, also, is far from inappli-

⁴ Meckel, Andral, Magendie.

cable, and fortifies this view of the subject; for Mr. Swan has himself observed, that nerves, like the muscles which they supply, grow larger from use; and it might be expected, therefore, that they would dwindle from desuetude.⁵

Of the simple functional disorders of the par vagum, producing symptoms of excitement, we know no more than that in many instances of nervous sensitive patients, and especially in girls about the period of the first developement of the sexual organs and consequent establishment of their function, we often meet with violent, deep, sonorous, paroxysmal cough, aggravated, rather than improved, by depletion, and cured by chalybeates. These are generally considered as connected with some functional derangement of the nervous system in general, but manifesting itself particularly in the pulmonary nerves. We might, perhaps, also be justified in referring to the same class of maladies, the occurrence of whooping cough, were it not that Autenrieth and Breschet are represented, in fatal cases of that disease, to have traced pathological changes, especially those of colour, in the pneumogastric nerves. I am not aware, nor have I had sufficient opportunities of doing so myself, whether the bronchial glands, enlargement of which will produce cough like whooping cough, have been particularly examined in these cases.⁶

It thus appears, that in all cases of unequivocal excitement of the par vagum, whether from mechanical irritation or from inflammation, cough of a violent and convulsive character is a general, if not universal, consequence of that morbid condition; and when, therefore, a question arises as to the exist-

⁵ Lobstein mentions his having found stony concretions adhering to these nerves, only to be separated by force; and in one instance a stone similar to the kernel of a cherry in the trunk itself of the par vagum, and its fibrils separated; the function of the lungs and stomach being unimpaired.

⁶ Recently four children have been brought to my house, labouring under whooping cough. In all, the *glandulæ concatenatæ* near the trachea were very considerably enlarged. Is this merely an accidental combination? or is there any essential connexion between the two? May it not be that an enlargement of these glands from a specific animal poison, similar to that of the parotid glands in mumps, is, after all, the essence of whooping cough? The subject at least deserves inquiry and further observation.

ence or non-existence of such a state of excitement of the nerve, we may safely conclude in the negative if such essential symptom be wanting.

How much of this cough is to be ascribed to the influence upon the pulmonic plexus, how much to that upon the recurrent nerves, it is difficult to determine. But as irritation of the lining membrane of the trachea, which derives its nervous energy from the latter, produces the same effect as excitement of the remote extremities of the filaments of the former in the lungs themselves in a state of disease, it is probable that both are affected. I am not aware of any experiments to illustrate the effect of irritating the recurrent nerves, to the exclusion of the pneumogastrics; but analogy would lead us to infer that cough would be one of its essential consequences, since irritation of the trunk of a given nerve is known to produce the same effect as irritation of its extremities; and it has been ascertained that chemical or physical excitement of the lining membrane of the trachea, which is the ultimate destination of some of the branches of the recurrent, whether from a few drops of blood, the vapour of acetic or of muriatic acid, a few drops of muriatic acid, or a ball of orris root,⁷ is productive of that vehement and anormal exertion of all the muscles supplied by the respiratory system of nerves, which constitutes spasmodic or convulsive cough.

The effects of excitement of the par vagum, after it has given off its branches to the respiratory and circulating systems, by mechanical, chemical, or morbid agents, have not been very minutely investigated. Irritation, however, of the œsophageal plexus by a scalpel, or spirit of wine, has been *seen* to excite the peristaltic action of the lower part of the œsophagus, of the stomach, and of the upper part of the alimentary canal.⁸ Excitement, therefore, of the par vagum, howsoever induced, may be expected to produce a morbid excess of nervous energy, which will manifest itself in the form of cramp, from anormal contraction of those muscular fibres upon which the motor filaments are distributed; and these probably, combined with gastrodynia and cardialgia, form the

⁷ Brachet.

⁸ Breschet and Edwards. Tiedemann and Gmelin.

morbid sensitiveness of the sentient extremities of the pneumogastric nerves upon the interior mucous lining of the stomach, which have been proved to be the means of conveying to the sensorium the sensation of hunger—" *le besoin des alimens*" of Brachet and the French physiologists. Accordingly, in an operation upon the common carotid artery by Mr. Vincent, it was observed on the day after the operation, that the patient had "much uneasiness and sense of fulness in the abdomen, extending from the epigastric to the right hypochondriac region;"⁹ and these symptoms, I am inclined to think with Mr. Vincent, were "fairly attributable to the presence of the ligature so near the par vagum, keeping up irritation upon it, as the whole sensation ceased the moment the ligature was removed."¹

In a case also by Lobstein, of tumour adhering to the small curvature of the stomach, both trunks of the par vagum were broken; the right one formed a lengthened ganglion, from which three tender branches went off. It is not easy to understand Lobstein's statement, that the nerves were broken through by the gradual growth of a tumour, which does not seem to have produced disorganization of any other surrounding organs. It appears, therefore, more probable that the solution of continuity in these nerves was the result of ulceration consequent upon inflammation, in the progress of which a lengthened ganglion was formed, probably, analogous to those tubercles, which sometimes occur from inflammation of the extremities of nerves in stumps, and manifesting the effects of morbid excitement in two very prominent symptoms of that state, "sudden heartburn," and "excruciating pains in the back and the interscapular region; to which were afterwards added an obstinate constipation and the most severe tormina, from which he died after the space of seven weeks." After all, however, it must be confessed that the symptoms which result from an excited state of those branches of the pneumogastric nerves, which are distributed upon the stomach, cannot be stated with precision, the facts collected

⁹ Med. Chir. Trans. vol. x. p. 214.

¹ Ibid, p. 217.

² Swan on the Nerves, p. 177.

upon the subject being comparatively few, and the nerves of that important organ being derived from various and complex sources.³

Of the Effects of diminished Energy in the Par Vagus and its Branches.

Having thus traced the effects, as far as I have had opportunities of collecting them, of excitement of the par vagum upon the organs which it supplies, we are prepared to consider the consequences of defective energy; and upon this point the experiments are almost endless, and the facts proportionately numerous: and although the statements of writers upon this subject appear somewhat to vary, according to the object which the experimenter has had in view and according to the organ influenced, yet, upon the whole, there is great uniformity in the results, as far as each organ is concerned.

In the early ages of physiological experiment and inquiry ligatures were more frequently employed to ascertain, by negative proof, the functions to which particular nerves were subservient, than either division or excision of a portion. Ligatures, however, have been found to vary in their effects, according to their thickness and the tightness with which they are drawn. If so thick or insecurely tied as not completely to "strangulate" the fibrils and intercept the course of nervous influence, the attributes of the nerve remain, or at all events return; or even, sometimes, inflammation succeeding, as a consequence of the mechanical violence, morbid excitement is the result instead of paralysis. But when the ligature is more slender, and drawn with such considerable force as effectually

³ "On sait qu'il existe, indépendamment de la double influence des nerfs cérébraux et des nerfs ganglionnaires, un troisième ordre d'influence nerveuse qui a sa destination spéciale dans l'exercice de la vie nutritive, et dont la connaissance devient indispensable à l'appréciation des phénomènes morbides de l'estomac. . . . C'est cette triple combinaison d'éléments nerveux qui semble expliquer aussi le triple caractère que peut affecter la gastralgie: 1. avec ou sans douleur; 2. avec ou sans spasme; 3. avec ou sans perversion de la sensibilité." —Jolly, *Dict. de Méd. et de Chirurgie pratiques, in verbo Gastralgie.*

to compress the medullary filaments and to overcome the protective influence of the elastic neurilema, the consequences are the same as those which result from the complete division, or even removal of a portion of the nerve; and this involves the annihilation of its function beyond the seat of injury. There is still another reason why the results of the application of ligatures, under the most favourable circumstances, are not so satisfactory as the division or excision of a portion. They are notoriously apt to produce suppurative inflammation of contiguous textures, and this may extend to the part of the nerve immediately above or in contact with the ligature, and essentially modify the results.

With the intention, therefore, of more completely cutting off the supply of nervous energy, physiologists have, in modern times, preferred division or removal of a portion of nerve, —more especially the latter, which is, upon the whole, less apt to produce inflammation, and, therefore, better calculated to illustrate the effects of defective nervous energy.

It is implied in the designation “pneumogastric nerves,” by which the eighth pair has been commonly known upon the continent, that its principal distribution is upon the respiratory organs and upon the stomach, in the functions of which important parts the effects of division, therefore, may be expected to manifest themselves. Inasmuch, however, as the par vagum sends filaments also to both the superior and the inferior cardiac plexus, it might be anticipated that the heart would be, at the same time, somewhat influenced. The consequences might be expected to be the opposite of those which I have already described as the result of excitement; and, with one exception, experiment amply verifies the anticipation of speculation. So, if the par vagum be divided at its origin, in the brain, the respiratory function is at once extinguished; all the respiratory nerves having their function annihilated, death is instantaneous. This was satisfactorily ascertained by Le Gallois, and subsequent experience has amply verified his observations. He sliced off the brain in successive layers till he arrived at the medulla oblongata, and life still endured.

He then carried his incision through the origin of the respiratory nerves, and life was instantaneously extinguished without a struggle.

It does not appear that Le Gallois cut through the pneumogastric nerves, at any point intermediate between their origin and the part at which the superior laryngeal nerve is given off, to ascertain how much of the effect of the former experiment was to be ascribed to the division of the eighth pair, how much to the coincident division of the other nerves arising from the respiratory column of the medulla oblongata; nor am I aware of any satisfactory experiments upon this point.

M. Bourdon is the only author, I have met with, who has noticed any difference of effect according to the part at which the nerve was divided; and he contents himself with stating, in general terms, that "it is well known that the division of the recurrent laryngeal nerves, or the division of the pneumogastrics between the superior and inferior laryngeal nerves, is more immediately dangerous than the division of the pneumogastrics high in the neck." The explanation of this is obvious. The source of immediate danger from the division of the par vagum between the two laryngeal nerves, is from destroying the balance of power between the antagonist muscles of the arytaenoid cartilages, and consequent closing of the glottis; but when both laryngeal nerves are deprived of energy, that chink remains immovably open.

Division of the par vagum below the superior laryngeal nerve, but before any other important branches are given off, produced, by the injury which the function of the cardiac branches sustain, some irregularity in the heart's action. This was well known to the physiologists of the seventeenth and eighteenth centuries, especially to Willis, Boyle, Lower, and Vieussens, and has been confirmed by the experiments of modern physiologists, especially M. Brachet, whose observation was particularly directed to this point. But the effect upon the action of the heart is only temporary; this organ speedily recovers its regularity of action; from which it may, perhaps, be inferred, that the branches, which the heart derives

from the eighth pair are not for its exclusive and regular action, but for those associated actions by which it is related to the respiratory function. At the instant of division of the par vagum, disturbance takes place from the mechanical violence done to the nerve ; but afterwards the heart beats regularly.

Pulmonary Nerves.

Division of the par vagum below the laryngeal nerve, besides the influence which it exerts through the recurrent branches, produces direct effects upon the lungs, upon the muscular fibres of the bronchi, and upon the lining membrane of the bronchial tubes and cells. The lungs are deprived of their sensibility to ordinary impressions, and even of the sensation of the necessity for breathing. An animal in whom these nerves are divided may be drowned without a struggle, or any manifestation of distress,⁴ although it is seen to gasp, to heave, to pant in its breathing, employing the subsidiary agency of the diaphragm, the abdominal muscles, and those other important muscles which, although supplied with spinal nerves for the purposes of voluntary movement, derive also a supply from the spinal-accessory, and external phrenic or respiratory nerve for those actions, by which they are associated with the respiratory functions. The palsied condition of the muscular fibres of the bronchi causes such an accumulation of the secreted mucus, as will, by inevitable consequence, produce first a mucous rattle or *rhonchus*, and remotely suffocation ; the bronchi and cells being found filled with frothy and, sometimes, brown or sanguinolent mucus, the vessels of the lungs gorged with black blood, and even the lungs themselves ecchymosed from extravasation under the investing pleura.

Stomachic Nerves.

With regard to the effects of division of the par vagum upon the stomach, there has been much difference of opinion.

⁹ Brachet.

All are agreed that it interrupts the digestive process; some, however, think that it does so by interfering with the secretion of that important agent in the process of digestion, the gastric fluid;⁵ whilst others maintain that this interruption is rather the result of defective muscular power, in consequence of which food accumulates in the stomach, and even in the lower part of the œsophagus, and is neither duly mixed with gastric fluid, nor efficiently propelled.⁶ The observations of Le Gallois, and even of Dr. Philip himself, seem rather to confirm the latter view of the subject. In the experiment of the former,⁷ the stomach was found at the end of four days and five hours enormously distended; but the food, except at the surface next the coats of the stomach, was wholly unchanged; in those of Mr. Hastings and Dr. Philip, at the end of twenty hours the stomach and œsophagus were also distended, and the food undigested.⁸ At first Dr. Philip imagined that “the sensation by which an animal judges when he has received enough of food, being destroyed by the division of the nerves, the animals had perhaps occasioned over-distention of the stomach, and thus destroyed the power of digestion, for they often ate a great deal after the operation;” but finding that the same suspension of digestion took place when food was taken immediately before the operation, and none after, he then adopted, what he apparently considered to be, the only alternative conclusion, namely, that the gastric fluid ceased to be secreted.

But in this, as in all scientific inquiries, it is requisite to bear in mind the distinction between the evidence of fact, and the evidence of opinion. In the fact that digestion is suspended by division of the pneumogastric nerves, all are agreed; that this arises from defective supply of gastric fluid is merely an inference, although it is stated, with that confidence which complete belief alone can justify, by Dr. W. Philip, who says, “the division of the eighth pair of nerves destroys the secretion of the gastric juice; but the animal still

⁵ Brodie, Wilson Philip.

⁶ Breschet and Edwards. Tiedemann and Gmelin.

⁷ Sur la Vie, p. 216.

⁸ Exp. Inq. p. 124.

living, and the motions of the alimentary canal being independent of the nervous influence, the usual motions of the stomach continue, and send onwards into the intestines all the food which is digested, and consequently can apply to the stomach that stimulus which excites its natural motions.”⁹ The experiments of Breschet and Edwards, however, confirmed by the observations of Tiedemann and Gmelin already adverted to, show that irritation of the œsophageal plexus excites the peristaltic action of the lower part of the œsophagus and of the stomach. Of this they had ocular demonstration; and the inference is irresistible, that paralysis of the same nerves would impair or entirely suspend the contractile power of the same muscular apparatus. *The facts* stated with minute accuracy by Dr. Wilson Philip himself, also, tend to show that this effect is produced by division of the eighth pair. It had been observed, by Sir Everard Home, that the food in the large extremity of the stomach of the rabbit was rolled into small round masses or balls about the size of the largest kind of shot, sometimes amounting to from two to four hundred, sometimes less numerous; and these, which were also “frequently found” by Dr. Philip, were thought by the latter distinguished physiologist to be formed in the rugæ of honey-comb appearance, and to be “*the food, by the action of this part of the stomach, rolled up into these masses.*” But no such round balls were observed when the pneumogastric nerves were divided, which affords strong ground for the belief that “the action of this part of the stomach,” upon which the formation of the round balls depended, *was* interrupted. No proof is offered that the secretion of the gastric fluid is suspended; on the contrary, all the facts point to the conclusion that it is continued. It is well known that one of the first effects of gastric fluid upon alimentary matters is to prevent such chemical changes as occur out of the body; and, when its formation is defective, eructations of an acid or acrid character prove that such chemical changes *are* going on in the stomach. It might be expected, therefore, that parsley or other vegetable substances, taken into the stomach, would

⁹ Exp. Inq. p. 154.

have fermented, but for the protecting influence of the gastric fluid which surrounds the alimentary mass. But whether the animal lived four days and five hours as in the experiment of Le Gallois, or twenty-four hours as in one experiment, or forty-five hours as in another experiment instituted by Mr. Hastings, "the food was very little changed."⁹ It is, indeed, said, that "in some places it was slightly changed," but the nature and precise situation of this change are not noticed. M. Brachet, however, in a series of admirably illustrative experiments upon this point, has supplied this deficiency, and shown that it is upon the *surface* of the alimentary substances contained within the stomach, that these changes occur, and that this surface is covered with a layer of chyme more distinct in the direction of the pylorus than the cardia. Whether the experiment was upon the dog, with dressed meat for his food,¹ or the horse with oats for his aliment,² or in the rabbit who had eaten leaves of cabbage,³ or in the guinea-pig with bread for its food,⁴ the result was invariably the same. The greater part of the food was undigested, but *the whole surface* of the alimentary mass was covered with a layer of chyme. It is clear, therefore, from these experiments, that gastric fluid continued to be secreted by the whole surface of the stomach, and influenced that portion of the alimentary mass with which it came in contact. Had this partial digestion been produced by the gastric fluid already accumulated, this would have remained at the most depending part of the stomach, and influenced the food only at that part; just as is known to happen in cases of solution of the stomach after death. But the first in the series of changes in digestion, after the food has reached the stomach, was produced upon the whole surface, and this could only have arisen from the gastric juice, as it was formed by the interior of the stomach, being gradually deposited upon the alimentary mass directly in contact with the secreting surface.

This organ, it is well known, performs another important

⁹ Exp. Inq. p. 164.

¹ Brachet sur les fonctions du système nerveux ganglionaire. Exp. liv. lvii.

² Ibid, Exp. lix. lxi. lxii.

³ Exp. lxiii.

⁴ Exp. lxx. lxxi.

office ; by its undulatory or peristaltic action it communicates movement to the alimentary mass, rolls it up into round balls in the rabbit, ⁵ and thus subjects in succession each portion to the influence of the gastric fluid as it is formed by the secreting apparatus upon the internal surface of the stomach. The muscular fibres of the stomach being paralysed, as far as contractile power is concerned, it is in the condition of the pig's bladder in the experiment of Magendie ; it cannot move the alimentary mass : but when accumulation takes place in the stomach so as to impede the descent of the diaphragm, and to produce discomfiture from distention of the abdominal parietes, and in the œsophagus so as, by pressure upon the fibrous structure at the back of the larynx, to embarrass respiration, contraction takes place in the respiratory and abdominal muscles ; the stomach is squeezed, as in a vice, betwixt the muscles, in their state of contraction, and the spinal column ; and, the lower part of the œsophagus, together with the stomach, being palsied, the food is rejected by vomiting, just as the coloured fluid in the pig's bladder, substituted for a stomach in Magendie's celebrated experiment, was ejected by these essential, though, it may be, generally subsidiary agents in vomiting.

That the par vagum is also the source of ordinary sensibility in the stomach, conveying to the sensorium the sense of the necessity for food, as well as of satiety, is satisfactorily ascertained ; and I have already illustrated this position by reference to the experiments of Le Gallois, Wilson Philip, and Brachet. It must follow, therefore, as a necessary consequence, that this influence being destroyed, the animal may continue to eat, until, as in the experiment of Le Gallois upon the guinea-pig, the stomach may equal in size the whole body, and prevent the animal from walking.

Hitherto I have purposely avoided noticing the effects of the diminution or total annihilation of nervous energy in two very important branches, the superior laryngeal, and the recurrent of the pneumogastric nerves. These I shall now proceed to consider.

⁵ Home, Philip.

Superior Laryngeal Nerves.

Amongst the earliest experiments upon the superior laryngeal, to the exclusion of the recurrent, branches of the eighth pair, are those of the late Dr. Haighton, his object being to ascertain the influence of the division of these nerves upon the voice, which he found to be "several notes flatter, though not much altered in its strength,"⁶ and the same result presented itself in a similar experiment by Magendie.⁷ This effect upon the voice, probably, may be explained by referring to another consequence of this experiment noticed by Magendie, taken in conjunction with an observation of Mr. Mayo upon the living subject. The former illustrious physiologist had observed that when he divided the superior laryngeal nerves, the edges of the glottis approached each other at their anterior part, but "there remained a sensible space at their posterior extremities; the two arytaenoid cartilages no longer applied themselves exactly to each other, as happens when the laryngeal nerves are uninjured;"⁸ and my indefatigable colleague, Mr. Mayo, looking into the cut throat of the attempted suicide, saw the edges of the glottis, in all attempts at vocalization, always assuming a parallel linear direction, and constituting a very narrow slit, instead of the triangular form which it preserved in ordinary respiration.⁹ The conclusion, therefore, drawn by Mr. Mayo, "that during vocalization the aperture of the glottis is reduced to a narrow longitudinal fissure"¹ is, perhaps, correct. When the superior laryngeal nerves are divided, the vibrations of the vocal chords, probably, continue perfect, because these are supplied by the recurrent; but the chink through which the sound issues is larger and of a different shape; and hence possibly the

⁶ Mem. of Med. Soc. of London, v. 3. p. 435.

⁷ La voix de l'animal perd presque tous ses tons aigus, en outre, elle acquiert une gravité habituelle, qu'elle n'avoit point auparavant.—Précis Elém. de Physiol. vol. i. p. 302.

⁸ Mémoire sur l'usage de l'épiglotte dans la deglutition, p. 5.

⁹ Outlines of Human Physiology, 3rd. ed. p. 349.

¹ Ibid, p. 350.

difference of intonation, without alteration of power in the voice. It seems, then, that the upper ligaments of the glottis only are affected by a division of the superior laryngeal nerves, and that these ligaments are the safeguard to prevent, by their closure during swallowing, the entrance of extraneous substances into the larynx; whilst the lower ligaments are the true vocal chords, which, by their vibration, are essential to vocalization, and the length and tension of which are influenced by the recurrent nerves.

Another evil consequence resulting from the extinction of nervous influence in the parts supplied by the superior laryngeal nerves, is a want of sensibility of the lining membrane of the upper edge of the rima glottidis. The result of this is, that there is no longer the power of warning the sensorium of the danger from the admission of foreign substances within that chink. This accident, therefore, would be very apt to occur from impaired sensibility, even if the closing muscles of the glottis retained their power of action. But muscular power and sensibility being both annihilated, the posterior extremity of the chink, deprived of feeling and remaining open, allows particles of food or other extraneous substances constantly to find their way, at least, as far as the inferior ligaments of the glottis. The membrane, however, which covers this lower part of the glottis, deriving its supply of nervous energy from the recurrent, retains its sensibility to impressions; its excitement, therefore, conveys the sense of danger to the sensorium; a vehement cough, with sense of suffocation, is produced for the expulsion of the foreign body; there is often temporary loss of voice, and there remains a tenderness of the vocal apparatus, with hoarseness, which renders each attempt to speak painful. These effects every one has occasionally experienced from something "going the wrong way;" and whenever from this accident there remain such hoarseness and soreness, we may safely conclude that the obnoxious substance has passed the upper boundary of the glottis, and penetrated beyond the superior ligaments, which under other circumstances would act, as a strainer or grating, to prevent

the entrance of noxious substances, and thus secure the vocal apparatus from injury; and hence one great advantage of there being two sets of ligaments, with a depression to separate them. The movements of the two are thus to a certain extent independent of each other, and the upper may, therefore, be closed during deglutition, whilst the lower are only moved during vocalization.

Recurrent Nerves.

Thus much, then, the experiments of physiologists teach us with regard to the superior laryngeal nerves, and the consequences of the annihilation of their function; those upon the inferior laryngeal, or recurrent, nerves, have been much more numerous, and, at the least, equally conclusive. The experiments upon the latter nerves were instituted originally to ascertain their effects upon the voice, and it was found that aphonia was the immediate result of tying, dividing, or excising a portion of them. This was ascertained by Rufus of Ephesus and Galen, by Mundingus in the fifteenth century, by Vesalius, the great opponent of the doctrines of Galen, and by Muralto. Dr. Martin also found that if one recurrent was divided "the voice became considerably weaker," but upon dividing the second nerve "the voice was entirely lost:" this was further confirmed by MM. Siie and Brunn. Yet, as there were still some who doubted or disbelieved the fact, amongst whom were Drelincourt and the eminent professor of anatomy in Edinburgh, Monro *primus*, an attempt was made to settle the question by a repetition of the experiment. Dr. Haighton, accordingly, divided in a dog both recurrents "carefully with a lancet, and soon after, upon stimulating him, he could make no other kind of noise but that of loud breathing. He was then remanded to his former state of confinement, where he had heretofore expressed great impatience by howling; but though he frequently made attempts, yet he could never exceed a wheezing kind of noise."² The body of evidence, then,

² Mem., of Med. Soc. of Lond., vol. iii. p. 432.

upon this point is so conclusive, as altogether to defy contradiction, and it may therefore be advanced as an indisputable proposition that the division of the recurrents destroys the voice. Drelincourt, who asserted the contrary, may probably have been misled by dividing the descending branch of the ninth pair as it passes along the sheath of the carotids, or the long cardiac nerve as it proceeds downwards; and Professor Monro probably erred by trusting too implicitly to his anatomical researches, without instituting sufficient, if any, experiments upon living animals.

Another effect of the division of the recurrent nerves is to destroy the power of the opening muscles of the glottis. This has been proved by a series of experiments admirably conceived and adroitly executed by Le Gallois, whose work, notwithstanding well-founded objections to some of his details connected with the influence of the nervous system upon the heart's action, will remain an imperishable monument of acute intelligence, active industry, and patient research. Having exposed to view the glottis, he observed that it opened and shut during the alternate movements of respiration; opening during inspiration, its edges very nearly approximating during expiration. Then dividing one recurrent, he saw the glottis, upon the corresponding side, at once deprived of all power of movement; the arytaenoid cartilage of that side remaining immoveably fixed in the central line, whilst the other cartilage still continued its movements.³ He then cut through the other recurrent, when the edges of both cartilages came in contact, the ligaments of the glottis at the same time having their sharp borders so close to each other that the chink appeared to be entirely closed. "Every effort to inspire only closed it more completely, instead of opening it; the pressure of the atmosphere favouring the further approximation of the ligaments in consequence of their oblique position, and of the *cul de sac* which they formed upon their anterior surface."⁴

Some, perhaps, might conjecture that this was a spasmodic closing: had such, however, been the case, the resistance to

³ Expériences sur le principe de la vie, p. 198.

⁴ Ibid. p. 199.

the passage of air in either direction would have been equal, but expiration appeared to be easy; and Le Gallois found that whilst a syringe, introduced into the trachea and directed upwards, propelled air with the greatest facility through the glottis, yet, when he attempted to draw air in the opposite direction, from above downwards, he felt a resistance similar to what would be produced by pressing the finger against the extremity of the syringe.⁵ The same effects were observed when the pneumogastric nerves were divided, the reason of which could not escape the common sense of Le Gallois, who well knew that the division of the trunk of a nerve involves the destruction of nervous influence in all its branches.

It was observed in these experiments, that the results varied in different animals, and even in the same animal at different ages; but *in all*, the sides of the glottis approached each other, even if they were not perfectly closed. Cats died of asphyxia from the closing of the glottis, more quickly than dogs. In rabbits and guinea-pigs the glottis was less completely obstructed, but still the dyspnœa was the principal cause of their death, which occurred generally in about an hour in the guinea-pig, but not for some hours in the rabbit;⁶ and Le Gallois adds, "this variation in the duration of life in these several animals, after such operations, depends upon the natural size of the glottis."⁷ In the dog and cat, as well as in man, the glottis is linear in its form when the sides approximate, somewhat triangular when open; but in the rabbit, at least in its expanded state, it is rounded; and this approach in shape to a curved line may preserve its sides from such nice adaptation to each other, as would immediately suffocate the animal when the closing muscles, no longer opposed by their antagonists, are in action.⁸

But age also modifies the results of these experiments, the risk of immediate suffocation being inversely as the age of the animal. Cats and dogs, fifteen days or three weeks old, had less dyspnœa than when the recurrent nerves were divided a few days after birth; but still they died at the end of a few

⁵ Expériences sur le principe de la vie, p. 199.

⁶ Ibid. p. 190.

⁷ Ibid. p. 194.

⁸ Ibid. p. 196.

hours. At the age of three months or more, dogs were not so inconvenienced, as to involve their destruction; cats were more so, and, if forced to walk, often fell down suffocated.⁹ It was the same with rabbits and guinea-pigs; the dyspnœa was less severe as they advanced in age, but it was always more distressing and hazardous in guinea-pigs than rabbits; in the latter, for example, they were less distressed at the age of one month than guinea-pigs at the age of five.¹ Again, in dogs, and especially cats, at a very early age, the contraction of the glottis was so great as to stifle them within the same period as when the trachea itself was tied; but as these animals grew, the danger was less pressing; and when they had arrived at a certain age the inconvenience was comparatively slight.² In all, however, the area of the glottis was sensibly diminished, and the embarrassment of the respiratory function proportionately considerable.

These are the principal effects observed upon dividing the recurrenents where the operation has been generally performed; that is, about the middle of the neck, near to the cricoid cartilage, and consequently after they have given off those filaments which supply the muscular fibres at the back of the trachea, together with its lining membrane. When these latter branches are also deprived of nervous energy, as in the experiment of dividing the par vagum itself, the expelling power of the tube is lost, as well as its sensibility. Mucus therefore accumulates in the canal; the rattle immediately becomes distinctly audible; but the animal suffers little or nothing. The due changes in the blood cease to be produced; the creature is asphyxiated,—sometimes convulsed; the lungs are found gorged with black blood, and are sometimes ecchymosed; whilst a frothy, sometimes brownish or sanguinolent serum clogs the cells. These changes have been proved and illustrated by the admirable series of experiments of M. Brachet, already detailed, and they appear to me so conclusive upon these points, that they require neither repetition nor corroboration.

I have already expressed my doubts as to some of the con-

⁹ Sur le principe de la vie, p. 192.

¹ Ibid. p. 193.

² Ibid. p. 232.

clusions drawn from the application of ligatures upon nerves. Le Gallois was also well aware of the sources of fallacy in such experiments, and therefore substituted either division, or the excision of a portion.³ All, however, are agreed, that if a ligature be efficiently applied, the phenomena will be the same as from division of a nerve. That aphonia has been the common, perhaps universal, result of tying the recurrent, has been known from the time of Rufus of Ephesus, and of Galen; and as this effect is now well known to be the result of a paralytic affection of the muscles which minister to vocalization, especially of those muscles which have for their office, by separating them in various degrees, to vary the length and tension of the vocal chords, there is every reason to believe that, in those cases, the area of the chink of the glottis must have been sensibly diminished. No one has of course ventured to institute such an experiment upon the human subject. This were worse than "*corio humano ludere.*" But there is strong reason to believe that the recurrent may have been occasionally divided with a knife, or included in a ligature, in the course of a surgical operation. Galen expressly mentions an instance in which the accident happened during the extirpation of a scrofulous tumour from the neck; and there is strong reason to believe, that at least in one recorded instance the recurrent has been included in a ligature, when a most appalling scene was the consequence. This case, in vol. xi. of the *Edinburgh Medical and Physical Journal*, was one of aneurism of the right subclavian artery operated upon by one of the most eminent practical surgeons of modern times, from whose well-earned reputation the occurrence of such an accident can detract nothing. With his usual address the operator laid bare the sheath of the carotid, which "was opened by pinching up a small portion of it with the forceps, and cutting the raised part with a knife carried horizontally. The director introduced at this opening, was passed down towards the thorax, and on it the sheath of this vessel, near to its root, was divided." "When the sheath of the carotid artery was divided, the eighth pair of nerves became visible; it lay deep, and to

³ Sur le principe de la vie, p. 203.

the outside, nearer to the carotid as they descended towards the thorax. An instrument similar to that above described, but of larger dimensions and greater curvature, was now employed to protect this nerve, together with the external jugular vein." "Only a small portion of the subclavian artery, lying between the aneurism and the forking of the innominata, remained in a sound state. The length of this sound portion did not exceed a quarter of an inch." Upon this portion, after repeated trials, in some of which there was reason to believe that the pleura was slightly wounded, the ligature was at length applied, and the results are interesting. "Prior to tightening the noose the breathing of the patient had become more laboured, and he complained much of an oppression at his heart. On tightening the ligature, these symptoms increased to such a pitch that every one present apprehended his immediate death. His countenance grew pale, and indicative of instant dissolution. Yet his pulse did not become intermitting, or in any manner irregular, as was observed by a gentleman, who, during these awful moments, kept his finger applied to the wrist. In this alarming state he continued for the space of about a minute, during which some of the assistants were so strongly impressed with the idea of his danger, that they quitted the room lest he should expire before their eyes."

It is scarcely necessary to state that the above are not the ordinary phenomena of wounded pleura, to which the distinguished operator was disposed to refer them. The breathing was not only oppressed, but positively extinguished for a while. The symptoms, moreover, did not appear till long after there was evidence of the pleura being wounded; and they only increased, to the "alarming pitch" described, "upon the tightening of the ligature." The occurrences, here mentioned, are notoriously and highly characteristic of sudden and strong pressure upon the recurrent nerve, and it is difficult to evade or deny the inference that this nerve must have been included in the "noose." Had the par vagum been included, the lungs would have been more embarrassed, and there would have been, at the least, uneasy feelings referred to the stomach,

as occurred in the operation for carotid aneurism performed by Mr. Vincent, who, in relating the case, says, "the uneasiness and feeling of fulness in the abdomen may be attributed to the presence of the ligature so near the par vagum, keeping up irritation upon it, as the whole sensation ceased the moment the ligature was removed."⁴ It is probable, therefore, that the recurrent only was included in the ligature; and this appears all but certain from the considerations, 1st, that the very small portion of healthy artery around which the ligature passed, and which did not exceed a quarter of an inch, was at the precise spot where the recurrent winds round that artery to cross behind the carotid; and 2ndly, that by the forcible traction outwards with the silver lever (for such in reality it was) used to protect the nerve together with the jugular vein, the loop of nerve must have been in a state of tension, and in close contact with the artery. It was, therefore, all but impracticable for the operator, dexterous and intelligent as he is known to be, to avoid such an untoward accident; and the risk should probably, therefore, constitute an important element in our decision as to the propriety of the application of a ligature around this particular part of the subclavian artery.

The forcible description of the formidable state of this patient, leaves little doubt upon my mind that he was in a state of what modern writers have denominated, without much attention to etymological accuracy, "asphyxia;" and this, in the language of a recent medical lexicographer, whose work is not more creditable to his patience, industry, and research, than valuable to the profession, "from deficient or impossible action of the inspiratory muscles," arising "from deficient or interrupted influence of the nerves supplying these muscles."⁵ It was a sudden but temporary suspension of the respiratory function, like that from drowning, hanging, or mephitic vapours, and this without even an imperfect inspiration; for the face remained "pale, and indicative of instant

⁴ Med. Chir. Tr. vol. x. p. 47.

⁵ Dict. of Practical Medicine, by James Copland, M.D. In verbo "Asphyxy."

dissolution." When the ligature, imperfectly secured, became loosened by the action of the artery, the disease subsided.

I shall conclude this brief outline of a very interesting operation by an observation which appears necessary to justify my doubts of the accuracy of the explanation of the symptoms offered by the ingenious surgeon who has given so ample and, evidently, so faithful a detail of the facts. It is this; that after the very decisive opinions founded upon the enlarged experience, and sanctioned by the recommendation, of Mr. Abernethy, as to the propriety of leaving occasionally a wound of the pleura open, or of making a small opening into the chest, as a remedial measure in cases of emphysema;⁶ after the interesting example related by Mr. Norris,⁷ of an extensive wound of the pleura inflicted by a plasterer's trowel, subsequently to which the patient walked a considerable distance in quest of surgical assistance; and after the numerous and conclusive experiments of the latter gentleman upon sheep, which continued to "go about without any apparent inconvenience," with extensive penetrating wounds of the thorax, it is impossible to assent to the proposition that the symptoms above adverted to could be owing to the admission of air within the cavity of the pleura. They were obviously the result of paralysis of the opening muscles of the glottis, consequent upon the compression by a ligature of that nerve, upon which their action, as proved by endless and incontrovertible experiments, depends.

Whatsoever differences of opinion may exist as to the effects of a moderate degree of pressure upon nerves at their origin, or in their course, it is at least almost universally agreed that if the compression be considerable, the result will be paralysis of the parts supplied by such nerves. It might be expected, therefore, that tumours contiguous to the recurrent nerves would produce consequences analogous to those from ligature or excision. It has accordingly been long known that aneurism of the thoracic aorta is often attended with occasional attacks of breathlessness, amounting to asphyxia, upon the

⁶ Surgical Works, vol. ii. p. 183.

⁷ Mem. of the Med. Soc. London, vol. iii. p. 448.

slightest exertion, and that it occasionally proves suddenly fatal without bursting. M. Bourdon was amongst the first to offer a rational explanation of the fact. He refers it to the effect of the aneurismal tumour (which, however, he appears to consider to be more allied to stretching, "*tiraillement*," than compression) upon the recurrent nerve. But the expression here employed by M. Bourdon is habitually used by the French writers, and not unfrequently in a vague, indefinite, or erroneous sense, without meaning more than what is now understood by the parallel phrases in the Roman medical classics, "*convelluntur*," as applied to nerves, or the "*convulsio* or *distentio nervorum*." The pneumogastric nerve indeed, passing as it does over the artery, might be put upon the stretch in this disease, but the recurrent, which passes behind it, would be rather the subject of compression, being placed between the aneurism and the bony textures at the back of the thorax. Paralytic asphyxia is consequently the result, or, as M. Bourdon announces at once the fact and the reason, "the superior laryngeal nerve going almost entirely to the muscles which close the glottis, and the inferior to those which dilate it, the latter are no sooner divided than the constricting muscles of the glottis, ceasing to be antagonized, act without opposition: and hence arises the suffocation observed under such circumstances. In this, too, may be seen precisely in what manner the aneurism of the arch of the aorta acts upon the voice: the left recurrent nerve which turns round that artery is stretched by the aneurism. The voice is at first altered, and sometimes also suffocation occurs from it, although the aneurism may not have burst. No one has tried tracheotomy under such circumstances. It has not yet been observed whether aneurism of the right subclavian artery produces accidents analogous to that of the aorta upon the voice."^a

An interesting case related by Mr. Lawrence goes far to supply the deficiency of information to which M. Bourdon thus adverts. In his very elaborate and valuable paper, "on some affections of the larynx which require the operation of

^a *Principes de physiologie médicale*; par Isid. Bourdon, partie ii. p. 678.

bronchotomy,"⁹ he relates the case of a girl, under twenty, who had great difficulty in drawing air into her chest, amounting to a sense of suffocation, coming on in fits, between which she was free from all complaint, her breathing and pulse being perfectly natural. "She died suffocated on the night following her admission into the hospital. Her disease was an aneurism of the arteria innominata, situated behind the first bone of the sternum and pressing upon the trachea. The front of this tube was pushed in by the tumour, so as to present a convex prominence on the inner surface, which, however, diminished its area in a very slight degree." Mr. Lawrence had desired that "he might be immediately sent for on the recurrence of a fit, supposing that bronchotomy might be required;" but it is to be presumed that the suddenness of the death of his patient prevented his wishes from being complied with. This distinguished surgeon concludes his account of this interesting case, with the striking observation—that "the termination of this case is the more remarkable, inasmuch as in another case, an aneurism rising out of the arch of the aorta and pressing upon the corresponding part of the trachea so as to produce ulceration of the internal membrane, under which there was a slight appearance of coagulated blood, caused no affection of the breath at all."¹

We are left to infer, with respect to the first of these two cases, that mechanical compression of the trachea was the cause of the death of the patient, although this tube was very slightly indented and free from disease, and although the attacks were only occasional and of short duration, "coming on in fits, between which she was free from all complaint, her breathing and pulse being perfectly natural." Yet in the second instance, so judiciously and usefully placed in juxtaposition and contrast with the first, for the purpose of directing the attention to the difference, although the pressure upon the trachea was much greater and more direct, and the amount of disease in the trachea very considerable, still there was "no affection of the health at all."

It can scarcely be necessary to protect myself from the ob-

jection which some might raise with regard to this case, that it is not, after all, the right subclavian, the artery referred to by M. Bourdon. Such cavilling, however, would be unworthy of any anxious inquirer after truth, as the recurrent nerve is, in its course upwards, always very close to, and, according to one anatomical writer, "passes from before backwards, round the arteria innominata." The influence will of course, therefore, be the same, whether the subclavian, at its origin from the innominata, or the latter artery itself be the seat of the aneurism.

The difficulty in reconciling the phenomena of these two cases led me to seek further for an explanation of the difference of symptoms and of result; and the key to the discovery of this is afforded by the observation, already referred to, of M. Bourdon, and by the experiments of Le Gallois, Magendie, Brachet, and numerous other physiologists, upon the pneumogastric nerves or their recurrent branches. In the first of Mr. Lawrence's cases, the recurrent nerve, which passes immediately behind the upper part of the innominata, where its continuation is about to become the common carotid, was compressed by the aneurism; in the second, that nerve escaped; and hence the sense of suffocation, coming on in fits, in the former case, its absence in the latter.

This view of the subject, which I long since² took the liberty to suggest, has since derived substantial confirmation from corresponding observations by two very eminent pathologists in Edinburgh. One is recorded by Dr. Robert Graham as "a case of aneurism of the aorta producing symptoms of laryngitis." That the symptoms were principally manifested in the functions of the larynx is unquestionable; but that the phenomena resembled those which characterise inflammation of that portion of the air tubes, is more than questionable. There was no fever, the cough was slight, the attacks of dyspnoea were occasional only and evanescent, and were always easily produced by the slightest exertion; they were accompanied with some degree of livor of countenance; and they

² Lond. Med. Gazette, April 5, 1834.

were often almost instantly removed, or at the least greatly alleviated, by breathing hot air, as from the door of a stove, or by inhaling steam. The phenomena, then, were not those of laryngitis, or inflamed larynx, but they were those of the "laryngismus" of Mason Good, as is proved by the "hoarseness," loud and stridulous respiration, with much oppression on the slightest exertion, the suddenness and want of continuousness of these attacks, and lastly, of paroxysmal cough, with occasionally mucous, sonorous, or sibilous râle. The cause of death in this case was a bursting of the aneurism, producing suffocation in a few minutes; and I am disposed much to coincide with this very eminent physician, that "there cannot possibly be an explanation of the symptoms, but by supposing them to be produced partly by the approaching rupture through the trachea, *but chiefly by pressure on the nerves supplying the glottis*; and the principal value of the case seems to be the proof which it gives that such symptoms may attend tumours in the situation occupied by the aneurismal sac here." The other interesting illustration of the same point was communicated orally to the Edinburgh Medico-Chirurgical Society by Dr. Alison, "where there were similar fits of urgent dyspnœa *with the crowing sound* on inspiration, and where it appeared on dissection that the recurrent nerve on one side had been stretched *and flattened* by the tumour, causing, probably, loss of its function, and consequent impossibility of voluntarily separating the arytaenoid cartilage, or antagonizing the action of the constrictors of the glottis when these were affected by spasm;" to which the only addition I should be disposed to make, would be, when that chink was closed by exertion, or by the associated movements of the constrictors, even in some of the more common and natural operations, as swallowing.

These cases, which have great intrinsic interest, are doubly interesting to me from their relation to the subject of the pathology of the laryngismus stridulus, and I would therefore strongly recommend them to the consideration of all, whom such inquiries can interest. I have for obvious reasons cur-

tailed them of their fair proportions, but they amply merit to be studied in detail.³

If the view, which I have thus ventured to take, of the occurrence of sudden death in some cases of aneurism of the arteria innominata, of the right subclavian, or of the arch of the aorta at the precise point where the recurrent upon the left side turns round that large vessel, be correct, it may be expected that other tumours in the same situation should also occasionally produce similar symptoms: and Cruikshank, upon whose accuracy and fidelity implicit reliance may be placed, has supplied us with an example of this kind. "I once knew," says that accurate writer, "an instance of these (bronchial) glands becoming scirrhus, and forming a considerable mass which, being prevented by the sternum from pushing forwards, pressed backwards upon the trachea, and compressed it in such a manner that its cavity was gradually obliterating. The man was for some time incapable of the least exertion or motion without running immediate risk of suffocation, and actually died one morning suddenly, as he was putting on his clothes." The glands, thus adverted to, were those in the immediate vicinity of the recurrent on both sides. The symptoms are *not* those of obstruction, threatening obliteration, of the air-tube, as all must admit who are conversant with the pathological history of croup and other affections of the larynx and trachea; but they *are* those of pressure upon the recurrent, whatsoever may be the cause of that pressure. In this case, then, the sudden death could not have well occurred from mere diminution of the area of the trachea. The effect in such cases would have been more permanent and aggravated; the dyspnœa becoming more and more oppressive and gradually fatal, in proportion as the progressive obliteration of the air-tube increased. Nor could it be ascribed to loss of blood; for this would have been ascertained by the same anatomical inspection which brought the disease of the glands into view. The "risk of suffocation" produced by exertion, (such exertion being incompatible even in idea with the gradual obliteration of the trachea,) must have arisen

³ See Edin. Med. and Surg. Journ. April 1835.

from some anormal action of the muscles of the glottis; and as the seat of the disease was distant from the part in which the symptoms manifested themselves, and directly in the course of those nerves from which the opening muscles of the glottis derive their influence, it is more than probable that the occasional, sudden, and temporary attacks of threatened suffocation must have originated in some impression upon those nerves. The instantaneous death, which eventually occurred, was but the more permanent and efficient agency of the same cause completely closing the glottis against the admission of air into the lungs, and thus destroying life in a manner analogous to, perhaps identical with, that in which death is produced by hanging or drowning, and even, possibly, by mephitic vapours.

That cause was made manifest by dissection. It consisted in a scirrhus affection, with great enlargement, of those glands, which are not unfrequently enlarged in infantile life, when they produce similar results; and with the greater certainty, because in infants the larynx is so much smaller, and consequently more easily constricted. In the case already quoted from the work of Cruikshank, the adult was liable to fits of breathlessness, one of which at last proved suddenly fatal. In children whose absorbent glands of the lungs have, from some morbid condition, become greatly increased in size, they, also, are subject to sudden and temporary interruptions to their breathing, fits of choking or suffocation, from which they recover with a sonorous crowing inspiration. At length, however, a more aggravated and permanent constriction of the glottis closes irrecoverably the entrance to the larynx and trachea, when the child, dying suddenly, is said to have been carried off by a "fit" or "convulsions"—terms which are used so vaguely and indefinitely both by the vulgar and, even, by the profession, that no inference of fact is to be drawn from their employment in the record of any given case, without an explanation of the precise sense in which it is used in such instance. The only difference in result from the agency of these causes upon the infant and the adult, where the attack is not fatal, is that the former generally recovers

with the crowing inspiration, the latter without it. This, however, is an accidental, not an essential variation, and depends upon the difference in size of the larynx. It has been already seen that this in different animals, and in the same animal at different ages, materially modifies the results of experiments, and the phenomena of disease are equally influenced by it. It has been well observed by M. Bourdon, that it is to the excessive narrowness of the glottis in early life, that the extreme danger of sore throats and croup is owing;³ and in women, whose larynx is three-tenths less than the larynx of the male, and only two-tenths more capacious than that of the child,⁴ the symptom is every now and then observed from causes which would produce no such occurrence in the male. Hence, probably, the inspiration "in that particular sonorous manner which is often observed in the hysteric paroxysm;"⁵ and hence, also, it may have been that in the *woman*, upon whom Sir Astley Cooper operated for carotid aneurism, "she hooped violently," after the paroxysms of cough occurring during the progress of the suppurative inflammation, which surrounded and laid bare the par vagum to the base of the cranium;⁶ and if from any cause, as the thickening from inflammation, the area of the glottis be reduced to the infantile size, then, with much greater certainty will be produced "a sound difficult to be described, but harsh, croaking, and sometimes would very much resemble that attending croup."⁷

This effect upon the nerves within reach of the influence of these tumid glands could not be that of excitement from impulse or irritation; for increased and anormal action of the opening muscles supplied by these nerves would be the result of such excitement; and the glottis would gape, instead of being closed, so long as the impression continued. It must therefore resolve itself into the principle of compression, paralyzing through the nerves the opening muscles of the glottis,

³ Principes de Physiologie Médicale, 2xième partie, p. 679.

⁴ Richerard.

⁵ Miller on the Asthma, p. 18.

⁶ Med. Chir. Tr. vol. i.

⁷ Dr. Jackson's Ed. Med. Com. vol. vi.

and thus allowing the muscles supplied by the superior laryngeal, now acting without antagonists, permanently and irrecoverably to close that chink.

In a case somewhat analogous, related by that indefatigable pathological anatomist, Dr. Hodgkin, in which a tendency to enlargement of the absorbent glands manifested itself in every part of the body, and seems to have been the prominent complaint of the patient, "death took place very suddenly, and apparently without previous warning." Dr. Hodgkin, with his characteristic caution, says nothing of the cause of this man's death; but "the veins of the head and neck were turgid, the bronchial tubes contained some thick mucus," and "*the glands along the subclavian arteries, and about the roots of the bronchi, were much enlarged.*" This combination of events leads me to suspect that the immediate cause of death was asphyxia produced by the pressure of the enlarged thoracic, subclavian, and, perhaps, cervical absorbent glands, upon the recurrent branches of the par vagum; although it must not be omitted that "the functions of the brain had been somewhat disturbed, and the left eye did not see so well as the right," symptoms which were afterwards traced to "thickness and opacity of the arachnoid, with infiltration of the pia mater."

Another very interesting example of the effects of pressure upon the respiratory nerves within the thorax, occasioned by an encephaloid tumour, has been recorded by M. Montault, Interne à l'Hôtel Dieu. This patient had nausea and vomiting, with a clean tongue, and constipation; general paleness, sleeplessness, variable pulse, catarrhal defluxion, *sense of suffocation, frequent cough with a sound like croup*, constriction of the throat ("gorge"), and sonorous mucous rattle over the whole chest. Upon some occasions the cough resembled that of hooping-cough; that is, after a long and sonorous inspiration there followed reiterated efforts of a cough, frequent and in jerks. After death, the precise mode of which is not stated, the lungs, heart, pericardium, œsophagus, and stomach were found healthy; but the bronchi, especially their ramifications, contained in considerable quantity a muco-purulent

substance, like that which the patient had expectorated in small quantity during life. Within the chest was an encephaloid mass, probably formed in the absorbent glands, which compressed some of the important nerves within the thorax. One portion, as big as a hazel-nut, at the anterior and inferior part of the trachea, surrounded and incased that tube, with which it communicated by a very small aperture; another, between the pulmonary artery and the arch of the aorta, was precisely in the situation occupied by the cardiac nerves; *a third, communicating also with the trachea, compressed the right recurrent nerve; and a fourth, much lower and to the left, implicated, and was completely confounded with, the recurrent of that side.*⁸

In the *Journal Analytique* for December, 1828, is the report of the case of a patient who died with symptoms of organic disease of the heart—probably, therefore, breathlessness and asphyxia—and in which the only discoverable morbid change consisted in the formation of scirrhus tumours, which compressed the phrenic and pneumogastric nerves, and the plexuses which proceed from the latter.

Amongst the “select communications from the Edinburgh Medico-Chirurgical Society,” is one of “diseased thymus gland,” in a child fifteen months old, apparently healthy, and of a full habit of body; but presenting, upon inspection after death, abundant evidence of scrofula, with which it seems the thymus itself was tainted, as well as the mesenteric glands. “It was observed, about five months before, that *when she was surprised or irritated, she was threatened with suffocation* from some obstruction in respiration. In the course of the last three or four weeks she was seized with two or three fits, but *in such a severe form that respiration was for a brief period suspended*. Her recovery from these attacks was rapid, and they seemed to leave no unpleasant consequences, for her appearance, in every respect, indicated a high state of health. On the 11th, whilst running on the floor, she fell, and *suddenly expired* in one (the fifth) of these fits.” It appeared,

⁸ *Journal Univ. et Hebdom. de Méd. et de Chirurg. Pratiq.* tome ii. p. 73.

upon examination, that the thymus was so large, as, when put into a measure-glass, to displace five drachms of water, and contained a cream-coloured or purulent fluid; the same being observed in the mesenteric glands, which "were in a scrofulous condition." "One portion of the gland rested over and pressed upon the right subclavian vein; another part of it lay over the subclavian coming from the left side, while a portion of it, in continuation of the part lying over the vein, extended upwards and backwards, and passed behind and under the vein, so that the left subclavian had three-fourths of its trunk completely imbedded in the gland." Now, the paroxysmal nature of these attacks, their peculiar character threatening and ultimately producing "suffocation from some obstruction in respiration," the rapidity of the recovery leaving "no unpleasant consequences," their reproduction by surprise or irritation, and the sudden death from suffocation without continuous laborious respiration, prove that these paroxysms must have arisen from the tumour affecting injuriously some of the respiratory nerves; and the symptoms as well as the direction in which the gland extended itself, whilst they all point to the recurrences as the nerves affected, may be considered, at the same time, as an additional evidence of the truth of Dr. Graham's observation, in the case already quoted from the same collection, "that such symptoms may attend tumours in the situation occupied by an aneurismal sac situated upon the arch of the aorta, which had by its pressure completely obliterated the cavity of the left subclavian artery; and it is unnecessary for me to point out how nearly identical must have been, in these two cases, the respective positions of the enlarged gland and of the aneurismal tumour."⁹

But the illustrations which I have hitherto adduced have reference only to pressure upon the recurrent, very near to its origin from the par vagum. Similar effects may be expected to result from compression of the same nerve in any part of its course. For reasons abundantly explicable, which, however, it is not necessary for me to consider here, the adult is less liable to such an occurrence than the infant. Hence

⁹ Edin. Med. and Phys. Journ. April, 1835, p. 289.

tumours in the neck, of very large size, are now and then presenting themselves, and yet they may embarrass very little, if at all, the respiratory function; as happened in a very interesting example of an enormous tumour on the right side of the neck, already noticed for another purpose,¹ which extended from the jaw to the edge of the axilla, and so deeply into the neck as to produce absorption of the transverse processes of more than one of the cervical vertebræ. There was no violent distress in breathing, nor indeed did it appear that the respiratory function was at all impaired; and this was obviously because the pneumogastric and recurrent nerves were neither implicated in, nor compressed by the contiguous disease. In the majority of instances, also, of bronchocele, there is no evidence of injurious compression either of the par vagum, or of the recurrent. But if a circumscribed tumour be placed directly over the course of the latter nerve, serious mischief is apt to result, and the patient may be even suddenly destroyed by it.

In the observations of Felix Plater is related the case of a boy, five months old, healthful and without other disease, who was carried off by difficulty of breathing, attended with sonorous respiration (stridore.) The body was opened at the desire of the father, who had lost two children from the same disease. A strumous gland, weighing an ounce and a half, was found attached to the great vessels, as they ascend the neck, by pressure upon which the child was believed to be suffocated.² It is now well known that such pressure as is here described, upon the great vessels of the neck, does not in point of fact produce the symptoms enumerated; but it is equally well known that they are precisely the phenomena which result from division, or from pressure which is equivalent to division, of the respiratory nerves, to the destruction of the influence of which the symptoms and fatal termination in this case should be referred. The effects are, in all respects, the same as those, which result from tying or dividing the par

¹ Essay, p. 138.

² Lib. 1. p. 84. This was obviously a case of the laryngismus stridulus, and from a very common cause of that disease.

vagus after it has given off the superior laryngeal nerve, or from instituting the same experiment upon the recurrenents in their course upwards.

Similar also in kind and in interest is the instance detailed by the celebrated Dr. Rush, under the title of, "An account of an asthma from an uncommon cause."³ This patient, a gentleman, twenty-five years of age, after recovery from a fever, was suddenly seized, after drinking a glass of claret, with hiccough, which continued without much intermission for eight or ten days, but then yielded to antispasmodic medicines. This was followed by a slight hoarseness, imagined to arise from nothing but a want of tone, and joined with a little defluxion from the trachea. Gentle exercise and a pretty free diet had no influence upon this; "the hoarseness still continued, and at times he found it complicated with a little difficulty of breathing, which, however, was relieved by a blister, and a day afterwards a gentle puke. The night but one after taking the puke, he waked suddenly out of his sleep, about eleven o'clock, with a most violent asthma; the fit again returned the next night at the same time, after which he never enjoyed a complete intermission of his disorder. He had a constant orthopnoea. He breathed so loud that he could be heard at the foot of two pair of stairs. His abdomen was drawn more inwards than is natural in each inspiration; he would frequently throw his head back to get breath, and during this time make a deep inspiration; he had some dozing; he coughed frequently towards the close of his disorder, and discharged viscid purulent matter without much relief; he used frequently to put his hand to his throat, and could sometimes feel a pricking pain a little below the cricoid cartilage on the left side of the trachea." Dr. Rush was now satisfied from the symptoms, which resembled those of two cases in Morgagni, that the disorder was occasioned by a tumour of some kind compressing his wind-pipe. But although this eminent practitioner and accurate observer was convinced of "the seat and cause of the disorder," and without hesitation declared that conviction to the patient and his friends, he was

³ Lond. Med. Obs. and Inq. vol. v. p. 96.

unable, although assisted in consultation by Dr. Kearsely, Jun., and Dr. Kulen, both physicians of eminence in Philadelphia, to detect it; for "there was no external swelling, or appearance outwardly, which could inform them of the precise seat, the depth, or the nature of the tumour which compressed his wind-pipe. The patient was, however, in conformity with Dr. Rush's opinion of the nature of the case, cupped upon the part, blistered upon the throat and behind the ear; he took calomel, gargled the throat, used the warm bath, and took pretty freely of cordial medicines, but without essential relief; for, in spite of all that could be done for him, he died on the thirteenth day after his attack of asthma. Upon examination of his body, "the lungs were found inflated with air but without disease or adhesion to the pleura; there was no water in the cavity of the thorax, and not above one ounce and a half in the pericardium: upon dissecting his wind-pipe a little from the fat and muscles in which it was lodged, there was found a tumour, about the size of an English walnut on the left side, near an inch below the cricoid cartilage, seated *partly on the trachea and partly on the œsophagus.*"

This case is interesting in several particulars. The name given to it might lead some to imagine that it was really asthma, and not that peculiar difficulty of breathing which results from an affection of the glottis. The principle, however, so usefully and admirably of late years employed in biblical criticism—that of making one part of Holy Writ interpret another—may be well applied to the productions of Dr. Rush; and it is well known that this writer has treated, under the name of "the spasmodic asthma of infants," that peculiar disease which has led me into this extensive field of inquiry; and he thus, by the employment of the same appellation for both, identifies the two maladies.

It moreover illustrates a very interesting fact in connexion with this subject, namely, the difficulty of detecting not only the precise nature, seat, and extent, but even the existence of tumours under the deep-seated fascia of the neck. The symptoms and the analogy of similar cases in Morgagni led Dr. Rush to infer that there was such a tumour: this conclusion

was assented to by his two colleagues in the consultation; remedies were employed in accordance with the impression; minute examination failed to detect it; and yet after death it was discovered equalling in size an English walnut.

It cannot fail to strike any one who at all reflects upon this case that the symptoms could not have been produced by the mechanical pressure upon the trachea: for, 1st, the symptoms were not those of continuous pressure upon the rings of the trachea: had it been so, the œsophagus, unprotected by the same elasticity as that which commonly protects from pressure the trachea, would have suffered more severely than the trachea itself; and yet no mention is made of dysphagia, as a symptom. This tumour was, however, directly in the course of the recurrent nerves, the compression of which, in all probability, occasioned permanent paralysis of that side of the glottis, and by interference with the natural association between the two (the movements of which, like those of the eyes, are synchronous) embarrassed the respiration of the patient, producing sudden difficulty of breathing, like that of asthma. Of this the hoarseness, and sonorous breathing, afford very strong collateral and corroborative evidence; and the air constantly rushing over the edge of that side of the rima glottidis, thus paralysed, produced the loud breathing which was heard at the foot of two pair of stairs.⁴ Other instances may be adduced of difficult breathing, or suffocation, from tumours pressing upon the respiratory nerves, in their course upwards. The indefatigable Bonetus has collected many such; amongst them is one in which there was loss of voice from a tumour, of the size of an egg, adhering equally to the trachea and the œsophagus, and consequently in that line between the two in which the recurrent lies imbedded.⁵ In another, a boy, ten years of age, fell from a height, but there was no external appearance of wound or bruise: at length he became *asthma-*

⁴ To the two last cases I have already alluded in illustration of the difficulty, which occasionally attends the detection of these tumours. They have, however, so intimate an alliance with the present branch of my inquiry, that I could scarcely omit considering them more at large, than was necessary for the object which I had then in view in introducing them.

⁵ Lib. 1. sect. 22. obs. 2.

lie, with loss of voice and speech. The precise mode of death is not stated, but there were found, near to the heart, many calcareous concretions adhering to the trachea and the left recurrent nerve.⁶ In a third, a man laboured under the greatest difficulty of breathing, without cough, asthma, or any known disease of the chest, and was at length carried off by fever. Various concretions of different shape lying upon the trachea so compressed it as to suffocate the man.⁷ Such concretions, however, as are here described could not, by mechanical obstruction of the trachea, have occasioned the distress, without, at the same time, producing cough, and that of a violent character. It is contrary to reason and observation; and we are left, therefore, to the inference that these substances must have influenced the respiratory nerves. In a fourth, a widow, a diffused (*humilis ac latus*) tumour, fixed to the side of the trachea, produced great impediment to breathing. This tumour appeared to be carcinomatous, and shot its ramifications extensively through every part of the neck. Here the tumour being to the *side of the trachea* could only interfere with the respiratory function by influencing its nerves.⁸ In a fifth, aneurism of the aorta, reaching by the side of the trachea above the sternum and clavicle, produced violent dyspnoea; and it may be inferred that it amounted nearly to suffocation from the case being related in the section “*de suffocatione*.” It may be further concluded that Bonetus believed these symptoms to have arisen from some affection of the nerves, from his adding, as an appendix to his account of the case, an observation of Willis, that “convulsive dyspnoea may arise from disease implicating and influencing the numerous ramifications of nerves which surround the lower part of the trachea.”⁹ In a seventh, a scirrhus tumour, reaching from the superior part of the lung to the upper part of the throat, produced laborious breathing, from the compression of the trachea producing narrowness and closing of its entrance (*meatus*.)¹ Pressure, however, of the trachea could scarcely diminish the area of the entrance to

⁶ Lib. 1. sect. 22. obs. 3.⁷ Lib. 2. sect. 1. obs. 3.⁸ Ib. obs. 5.⁹ Obs. 7.¹ Obs. 8.

this tube, protected, as it there is, from injury and change of form by the cricoid cartilage, unless it exerted its influence upon the recurrent. In an eighth, quoted from Plater, obs. lib. i. p. 180, dyspnœa was produced by a glandular disease at the entrance to the thorax (in pectore circa jugulum). In a ninth, a youth died of suffocation, from strumous glands, which, according to Bonetus, compressed equally the œsophagus and trachea;² but as the case is related in the section “*de suffocatione*,” and as there is no account of any difficulty of swallowing, the exclusive effect upon respiration is only explicable upon the supposition that the nerves subservient to that function were affected, and *the situation, between the trachea and œsophagus*, points to the recurrent as implicated. In a tenth, a boy, fifteen years of age, had most difficult breathing, (*de difficillima respiratione conquerebatur*,) from small schirrous glands, one of which, somewhat larger than the rest, dissected from the lung, discharged strumous and diluted blood.³ In an eleventh, quoted from Gregorius Horstius, an aneurism of the aorta, without bursting, produced fatal suffocation (*ob sanguinis ebullitionem et incandescientiam*);⁴ the fact is probably unquestionable, and admits of explanation upon the principle particularly alluded to by M. Bourdon, of the pressure, or “*tiraillement*,” of the recurrent, but not so satisfactorily upon the assumed principle of the boiling or roasting of the blood.

Dr. Rush, in his paper upon “asthma from an uncommon cause,” has, as I have already stated, alluded to two cases in Morgagni which he thinks were similar to that, which he has described. But, whilst there are points of resemblance between them, there are also important differences. In the first of the cases to which he has referred, there was ulceration of the larynx, with secretion of pus; and in the second, there was such mechanical compression of the œsophagus, and upon the trachea, as materially to contract the area of both these canals. It is, however, far from improbable that in the latter instance the tumour, from its peculiar position, may have also influenced the recurrent nerve.

² Obs. 136.³ Lib. ii. sect. 2, addit. obs. 4.⁴ Obs. 14.

At the conclusion of the chapter on the "Pathology of the Laryngismus Stridulus," I have briefly related the circumstances of a fatal case of cynanche parotidæa, in which it appeared not improbable that the sudden death was owing to pressure upon the par vagum. I proposed this, however, only as a probable explanation, not as a point ascertained. At all events, it affords the most satisfactory interpretation of the symptoms.

Veterinary medicine, also, supplies us with some very interesting facts concerning the effects of pressure upon the par vagum or its recurrent branches; this being, in the opinion of M. Dupuy, not only the most frequent but the sole cause of the sonorous inspiration in the *cornage* or *roaring* of the horse. This pathological connexion has not, however, been much, if at all, noticed, and is not generally credited in this country; though I am inclined to think that there is more foundation for the opinion, than our veterinary surgeons, with one eminent exception, are disposed to concede to it.

The facts upon the subject recorded by M. Dupuy appear to be well authenticated, and nearly conclusive as to, at least, the occasional dependance of roaring upon such compression by enlarged and indurated glands; and it is interesting to observe the close analogy which obtains between that complaint in the horse and the laryngismus stridulus in the child. In both the disease consists of paroxysmal difficulty of breathing, with a loud sonorous inspiration, not observable in general when either is at rest, but readily excited by any violent exertion, especially whilst the stomach is loaded.

In the first case mentioned by M. Dupuy the horse was affected with the *cornage* in a very severe degree, and when destroyed for the purpose of dissection it was found that the two pneumogastric nerves passed across a fibrous tumour, situated in the anterior mediastinum; and that this tumour, partially movable, stretched or compressed those nerves only when in exercise, and then alone the respiration was attended with the peculiar noise. The animal died of asphyxia from being made to go fast for half an hour.⁵

⁵ If this tumour was in the anterior mediastinum, the nerves must have been behind it, and therefore, although they may have been carried somewhat out of their natural course, they must have been rather compressed than stretched.

In another horse, equally the subject of this disease, dissection exhibited "the lymphatic glands, at the entrance to the chest and about the division of the bronchi, very much enlarged and indurated, and compressing forcibly the recurrent or inferior laryngeal nerves."

Similar symptoms, with the addition of difficulty in swallowing either solid food or liquids, were observed in a cow from a cyst of the size of an infant's head, which compressed the pharynx. "In a sort of fissure between two of the elongated processes of this tumour were several nervous cords, which careful dissection proved to belong to the eighth pair, whilst the recurrent or inferior laryngeal nerve made a remarkable turn around this tumour before it proceeded to its destination; these nerves were singularly stretched by the cyst," I should be disposed to add, from the relative situation of these parts, that the nerves must have been compressed:—but it is of little moment to determine this point since there is strong reason to believe that stretching of a healthy nerve will produce the same effect as pressure.

Phenomena very similar were observed in a dog in which, upon opening the body after death, tumours of a schirrous hardness were found compressing the trachea, the œsophagus, and the nerves of the eighth pair at their entrance into the chest *before* they had given off the recurrent branches.

M. Dupuy also produced the same symptoms by imitating this compression of the pneumogastric nerves in the middle of the neck, and he entertained more than a suspicion that these effects were owing to the paralysis occasioned by such compression of the recurrent or inferior laryngeal nerves, which are distributed upon the dilator muscle of the larynx; whilst the superior laryngeal nerves, as well as the constrictor muscles, retaining the former their energy, the latter their contractile power, the lips of the glottis approach each other, the aperture is more or less exactly closed, and the respiration consequently becomes extremely laborious and sonorous.⁶

⁶ Le 8 Février dernier nous avons fait de nouveau la compression des nerfs pneumo-gastriques au milieu du cou. Une demiheure environ après, la respiration est devenue bruyante et semblable à celle des chevaux affectés du cornage.

Mr. Swan has assured me that he has seen in one instance in the "roaring" horse the posterior crico-arytænoid muscle of one side much smaller than upon the other. This implies a withering with consequent enfeebled power, which would be equivalent in effect to paralysis of the nerve which supplies this opening muscle of the glottis. It is far from improbable that this change of the muscle may have arisen from atrophy, the result of some previous pressure or disorganization of the recurrent or its parent trunk, the pneumogastric nerve. The nerve, indeed, was not particularly examined, or at least no memorandum was preserved of its condition; but it is rare for a muscle to wither unless from disuse or disease, or from some injury which occasions defective energy in the nerve which supplies it.

One of our most intelligent veterinary surgeons, Mr. Field, has also been kind enough very recently to show me two preparations taken from horses, that had been the subjects of *cornage*, or roaring, in which the same pathological condition was most conspicuous; and in one of these the recurrent nerve of the corresponding side was sensibly smaller than upon the other. But, Mr. Field has carried his researches further. M. Dupuy had, as we have seen, produced the essential symptoms of *cornage*, "a sonorous inspiration upon exertion" by compressing the pneumogastric nerves in the middle of the neck. Mr. Field has, by direct experiment, succeeded in proving that which M. Dupuy had more than suspected, that this must have been from the effect being communicated to the posterior crico-arytænoid muscle through the recurrent nerve, which endows that muscle with nervous energy, and

Il résulte de cette expérience qu'on peut déterminer la *cornage* à volonté, en comprimant les nerfs de la huitième paire au milieu du cou; qu'on le fait cesser en pratiquant la trachéotomie, et qu'on renouvelle ce bruit particulier, lorsqu'on bouche l'ouverture de la trachée. On conçoit facilement que cette compression occasionne la paralysie des nerfs récurrents ou laryngés inférieurs, dont les filets se distribuent aux muscles dilatateurs du larynx: tandis que les laryngés supérieurs jouissant de leur énergie ainsi que les muscles constricteurs, les levres de la glotte se rapprochent, l'ouverture est plus ou moins exactement fermée et la respiration devient alors très-laborieuse et très-bruyante.—*Journal Général de Médecine*, &c. Avril, 1821.

consequent contractile power ; for he has produced “roaring” instantaneously by excision of a portion of the recurrent upon one side. In a pony, never before subject to the disease, immediately after a gallop in which it manifested not the slightest symptom of the complaint, he divided the nerve ; it was immediately, and ever after, a roarer ; and upon examination, at a remote period after the operation, he found the nerve much atrophied and the muscle withered.

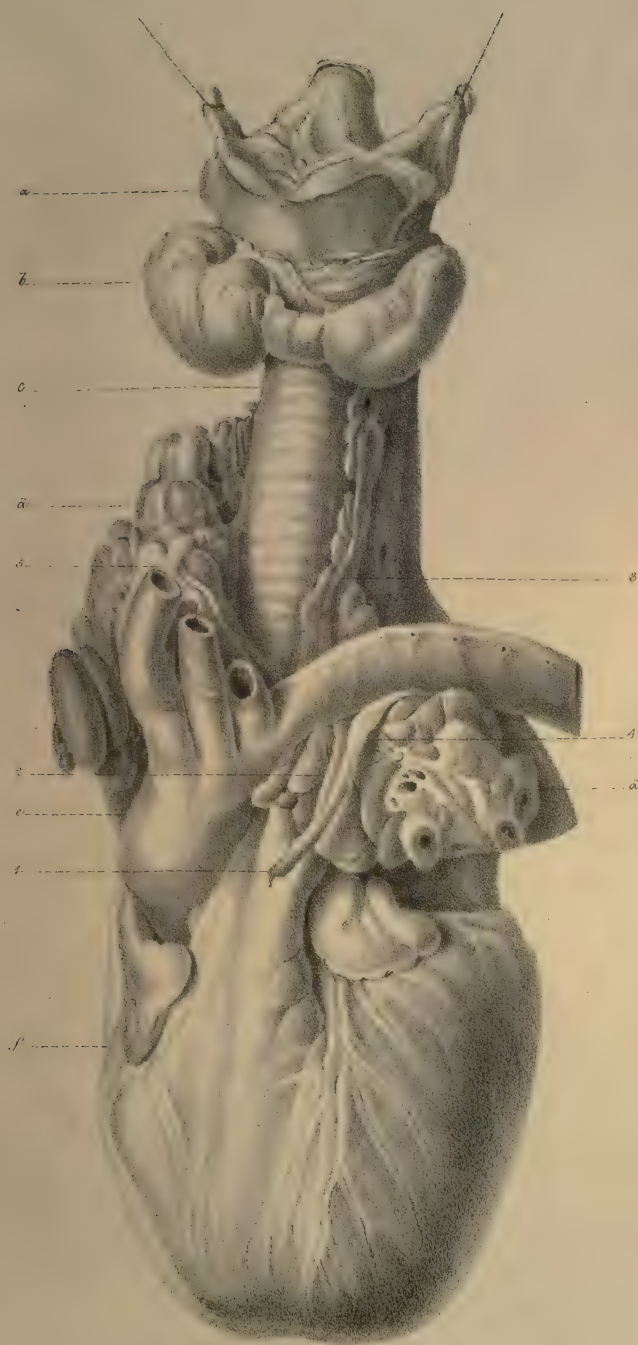
How completely the pathological fact here coincides with the physiological experiment, and both with the phenomena of the laryngismus stridulus, it is scarcely necessary to trace. The relation between them all is too prominently marked to escape even the most superficial observer, and they admirably and reciprocally illustrate each other.

Such, as far as I have been able to collect them from authentic sources, are the principal attributes, in their natural and diseased conditions, of the pneumogastric nerves and their branches, especially the recurrents. If other facts were required to prove the effects of compression of the latter in their course, I might refer with confidence to the phenomena of that disease (the laryngismus stridulus) which led me to investigate the intricate and interesting subject of the pathology of nerves in general, to draw such inferences as the numerous and well-authenticated individual facts, which are dispersed throughout the extensive records of medicine and surgery, appeared to warrant, and to apply those general inductions to the diseased conditions of the principal ramifications of the eighth pair. But I forbear to trespass further upon the patience of my readers, which I fear the extent of my illustrations may have put to severe trial ; and it is unnecessary, as I have already dwelt somewhat at large upon this branch of the subject, when considering the essential nature of the crowing inspiration of infants, not connected either with croup or hooping-cough.

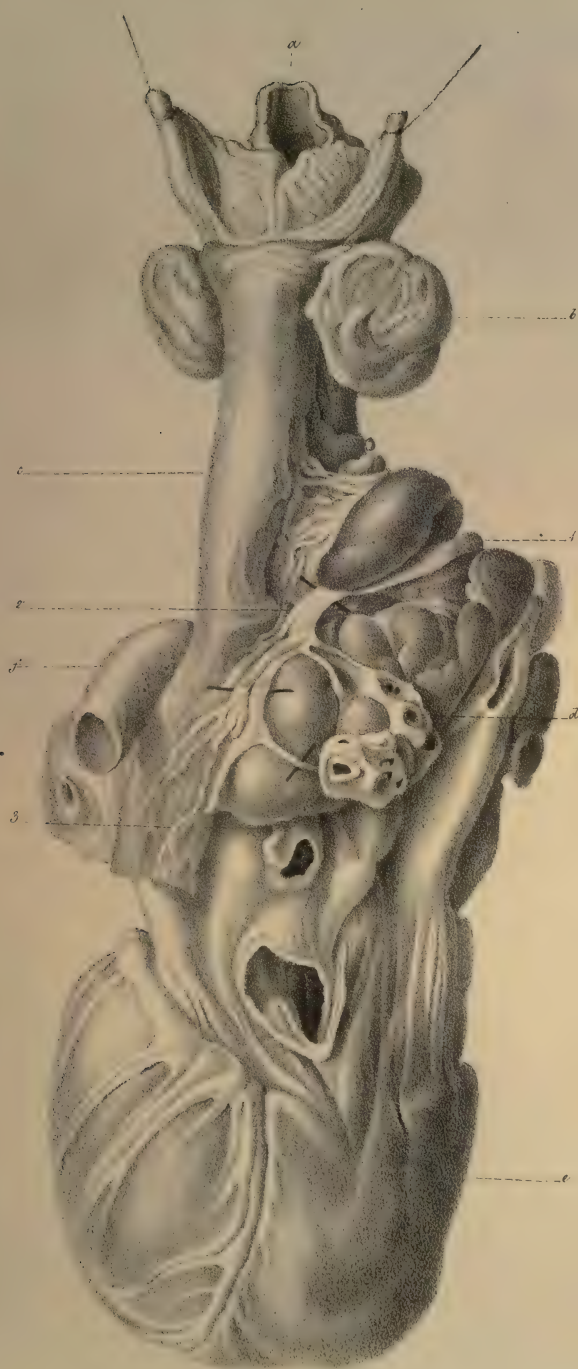
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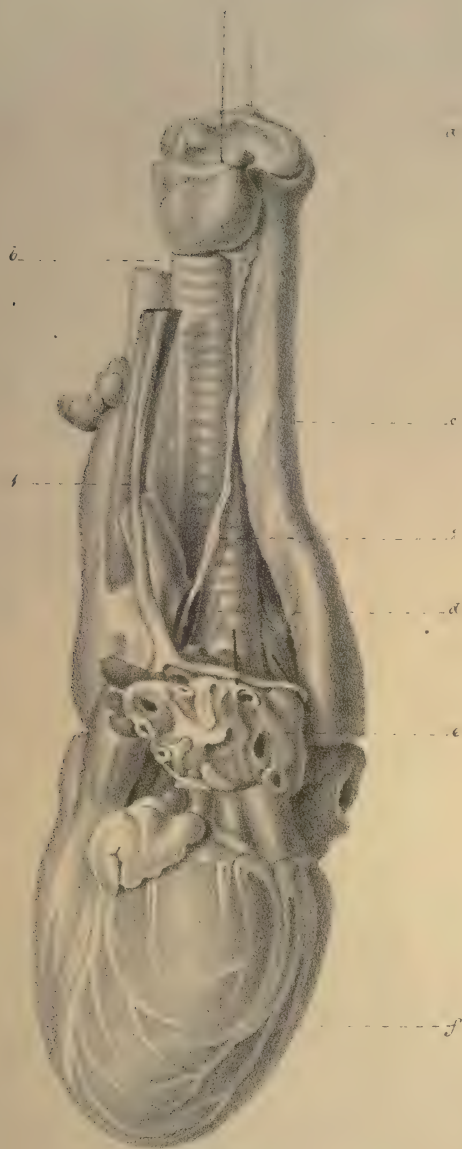
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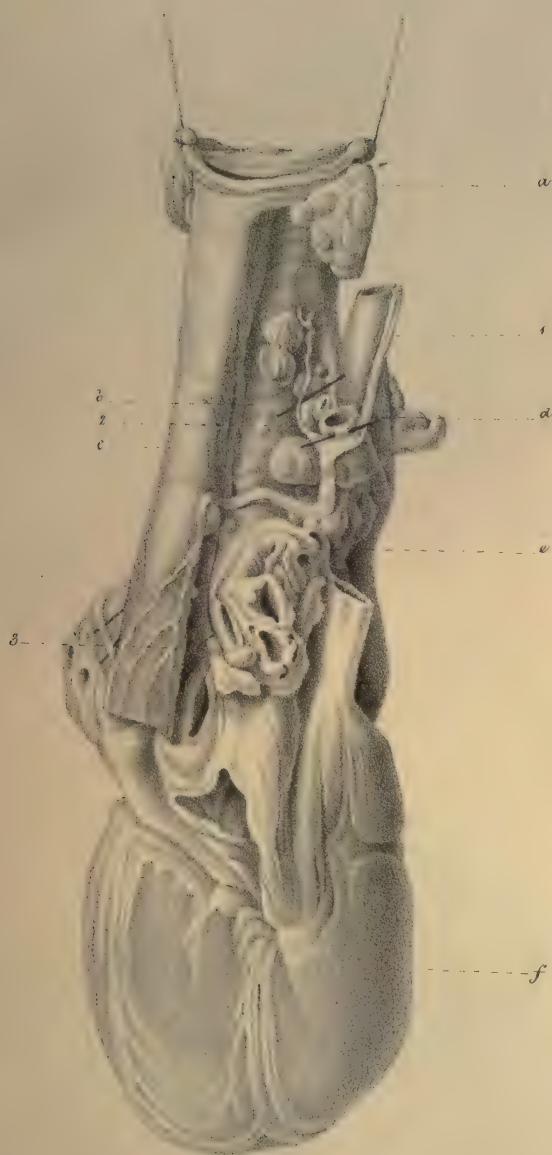


Fig 1

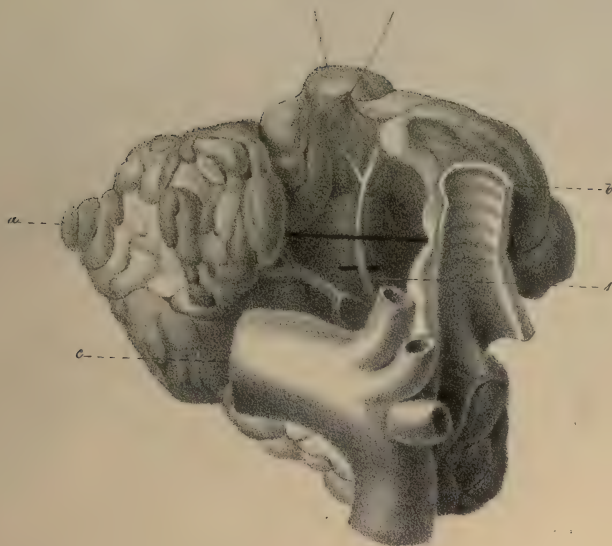
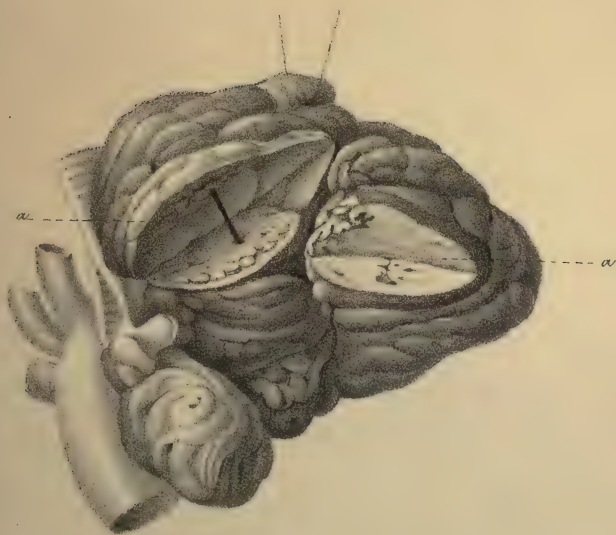


Fig 2.



EXPLANATION OF THE PLATES.

PLATE I.

Represents a Mass of enlarged Bronchial Glands, compressing and flattening the Pneumogastric and Recurrent Nerves upon the left Side.

- a.* The Larynx.
- b.* The Thyroid Gland.
- c.* The Trachea.
- d.d.* Masses of enlarged Bronchial Glands.
- e.* The Aorta.
- f.* The Heart.

1. The Nervus Vagus of the left Side, with the reflection of the Recurrent Nerve.
2. The left Recurrent Nerve compressed and flattened.
3. The same Nerve emerging from a glandular mass in which it was imbedded. It had lost its ordinary character, and resembled mere cellular tissue.
4. Prolongation of the Nervus Vagus flattened by pressure between the Aorta and the enlarged Bronchial Glands.

EXPLANATION OF THE PLATES.

5. The Cardiac Nerve descending to join the lateral Cardiac Plexus.

PLATE II.

Posterior View of the same Parts as in Plate I.

- a.* The Epiglottis.
 - b.* The Thyroid Gland.
 - c.* The Œsophagus.
 - d.* Bronchial Glands morbidly enlarged, and pierced by the Bronchi.
 - e.* The Heart.
 - f.* The descending Aorta.
1. Prolongation of the Nervus Vagus. (See Plate I. No. 4.) much flattened by the pressure of a super-incumbent Gland.
 2. A flattened and expanded portion of the same Nerve, where it is about to form the Pulmonic Plexus.
 3. Œsophageal Nerves reduced, in consistence, nearly to the condition of pulp.

PLATE III.

Represents the left Recurrent Nerve flattened and withered from pressure.

- a.* The Larynx.
 - b.* The Trachea.
 - c.* The Œsophagus.
 - d.* The Aorta, drawn by the weight of the heart from its position, and thus exposing the origin of the Recurrent Nerve.
 - e.* Enlarged and indurated Bronchial Glands.
 - f.* The Heart.
1. Nervus Vagus of the left side passing in front of the Aorta.
 2. Recurrent Nerve atrophied by compression, between the

EXPLANATION OF THE PLATES.

Aorta (*d*), when in its natural situation, and the enlarged Bronchial Glands (*e*).

PLATE IV.

Another view of the same preparation as in Plate III., showing the effect of pressure upon the right recurrent Nerve.

- a.* The Thyroid Gland.
 - b.* The Trachea.
 - c.* The Œsophagus.
 - d.* The right Subclavian Artery, around which the Recurrent Nerve of the right side is seen to wind.
 - e.* Enlarged Bronchial Glands.
 - f.* The Heart.
1. Nervus Vagus of the right side accompanying in its descent the Carotid Artery.
 2. The Recurrent Nerve compressed and flattened by contiguous Glands. It is nearly as thin as silk riband, and atrophied in its course upwards.
 3. Œsophageal Nerves flattened and softened.

PLATE V.

Represents the mass of enlarged Bronchial Glands referred to in the Note at page 191.

FIG. 1.

- a.* Enlarged Bronchial Glands.
 - b.* The Trachea pushed to one side.
 - c.* The Aorta hanging by a filament of cellular membrane.
1. A Nerve originally situated close to the edge of the Trachea—believed to be the Recurrent—much compressed and withered. The two extremities, however, of this Nerve not having been traced, it is not impossible that it may be the long Cardiac Nerve.

EXPLANATION OF THE PLATES.

FIG. 2.

Presents another view of the same mass of Glands.

- a.a.* Incisions made into some of these glands to show the breaking down of texture, with the flaky, or curdy, appearance so characteristic of the suppurative process in scrofulous habits.

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